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MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—Linnæus.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—Bruckner, *Théorie du Système Animal*, Leyden, 1767.

. . . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. Taylor, *Norwich*, 1818.

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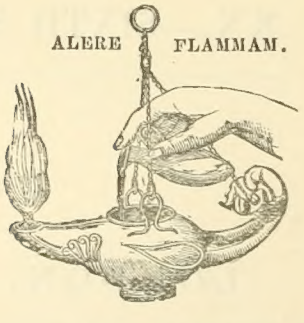

ANNOUNCEMENT.

THE present Number completes the Sixth Series of the 'Annals,' and I avail myself of this occasion to pass the responsible editorship over to my Son, who for some years past has largely assisted me in the management, and who is fortunate in retaining the co-operation of the two co-Editors whose names appear on the Titlepage, and whose advice has always been at my service during the twenty years I have been associated with them.

It is now more than 60 years since, fresh from my studies at the University of Berlin, I was consulted by Mr. Richard Taylor as to the probability of such a Journal meeting with sufficient support. The two Natural History Journals then existing in this country were Loudon's, subsequently Charlesworth's 'Magazine,' and the 'Magazine of Zoology and Botany' conducted by Sir William Jardine, Dr. Johnston, and Mr. Selby. This latter Journal was about to be discontinued, and the same fate seemed likely to result in the case of Sir William Jackson Hooker's 'Botanical Companion.' In these circumstances it was suggested to Mr. Taylor that by amalgamating the two there would be a greater chance of success.

The two most important Journals on the Continent at that time devoted to Natural History were the 'Annales des Sciences Naturelles' and the 'Archiv für Naturgeschichte,' recently founded by my friend and teacher Professor Wiegmann.

At a meeting arranged by Mr. Taylor, at which Sir W. Jardine and Sir W. J. Hooker were present, and which I was

invited to attend, it was considered that a Journal conducted on lines similar to these Continental Journals would be welcomed by British Naturalists, and the 120 Volumes are evidence that the expectation then entertained was well founded.

Sir W. J. Hooker's connexion with the 'Annals' terminated with Volume IV., as it was impossible to find room for the long communications from Botanical Travellers, which, although very interesting, did not appear to be suitable for publication in its pages. Charlesworth's 'Magazine' was absorbed into the 'Annals' in 1840.

In the Preface to the First Volume of the Second Series the Editors acknowledge "the aid of Dr. W. Francis, as from the commencement of the work they have had the advantage of his constant and valuable assistance in its regular production;" and in January 1859 my name was added to the list of Editors.

Although the publication of this Journal has been by no means a source of any considerable profit, I have been amply rewarded, as it has procured for me the friendship of most of the eminent men who have contributed so largely to the vast progress of Natural History during Her Majesty's reign. May I hope that the same good fortune will attend my successor, and that he will receive the same friendly assistance from those who are now devoting themselves to the advancement of those departments of Science for the promotion of which this Journal was founded.

WILLIAM FRANCIS.

CONTENTS OF VOL. XX.

[SIXTH SERIES.]

NUMBER CXV.

Page

I. The Actiniarian Family *Aliciidæ*. By J. E. Duerden, A.R.C.Sc.(Lond.), Curator of the Museum of the Institute of Jamaica. (Plate I.) 1

II. On a Collection of Heterocera made in the Transvaal. By W. L. Distant 15

III. *Cicadidæ* from the North Chin Hills, Burma. By W. L. Distant 17

IV. Contributions from the New Mexico Biological Station.—No. II. (*continued*). On a Collection of Diptera from the Lowlands of the Rio Nautla, in the State of Vera Cruz. II. By C. H. Tyler Townsend, F.E.S. 19

V. The Species and Subspecies of Zebras. By R. I. Pocock, of the British Museum of Natural History 33

VI. Aquatic Rhynchota: Descriptions and Notes.—No. I. By George W. Kirkaldy 52

VII. New Cyclostomatous Bryozoa found at Madeira. By James Yate Johnson, Corr.M.Z.S. 60

VIII. On Lepidoptera Heterocera from China, Japan, and Corea. By John Henry Leech, B.A., F.L.S., F.Z.S., &c.—Part II. Family *Geometridæ*; Subfamilies *Œnochrominæ*, *Orthostixinæ*, *Larentiinæ*, *Acidaliinæ*, and *Geometrinæ* 65

IX. On new Species of Rhopalocera from Toungoo, Burma, and the Battak Mountains in Sumatra. By Major J. M. Fawcett 111

X. Description of a new Rat from China. By Oldfield Thomas 113

New Book:—Ueber die Palpen der Rhopaloceren. Ein Beitrag zur Erkenntnis der verwandschaftlichen Beziehungen unter den Tagfaltern. Von Enzio Reuter 114

Proceedings of the Geological Society 116

NUMBER CXVI.

Page

XI. Notes, Morphological and Systematic, on the Madreporarian Subfamily *Montiporinæ* (*Montipora* and *Anacropora*), with an Account of the Phylogeny of the *Madreporidæ*. By H. M. Bernard, M.A. Cantab. (Plate II.) 117

XII. Contributions from the New Mexico Biological Station.—VI. The New Mexico Bees of the Genus *Heriades*, and a new *Halictus*. By T. D. A. Cockerell 135

XIII. Revision of the Pierine Butterflies of the Genus *Delias*. By A. G. Butler, Ph.D., &c., Senior Assistant-Keeper, Zoological Department, British Museum 143

XIV. Notes from the Gatty Marine Laboratory, St. Andrews.—No. XVIII. By Prof. M'Intosh, M.D., LL.D., F.R.S. (Plate III.) 167

XV. On new Species of *Histeridæ*, and Notices of others. By G. Lewis, F.L.S. 179

XVI. On a Collection of Heterocera made in the Transvaal. By W. L. Distant 197

XVII. Descriptions of Two new Species of *Amphidromus*. By Hugh Fulton. (Plate VI.) 211

XVIII. On supposed new Species of *Oleacina*, *Trochomorpha*, and *Bulimulus*. By Hugh Fulton. (Plate VI.) 212

XIX. On some small Mammals from Salta, N. Argentina. By Oldfield Thomas 214

XX. Descriptions of Four new South-American Mammals. By Oldfield Thomas 218

XXI. On the Anatomy of *Apera Burnupi*, E. A. Smith. By Walter E. Collinge, F.Z.S., Assistant Lecturer and Demonstrator in Zoology and Comparative Anatomy, Mason University College, Birmingham. (Plate V.) 221

XXII. Description of a new *Papilio* from Bali of the *nox* group. By Lionel de Nicéville, F.E.S., C.M.Z.S., &c. 225

XXIII. Description of a new Ceratopterine Eagle-Ray from Jamaica. By G. A. Boulenger, F.R.S. 227

XXIV. On Lepidoptera Heterocera from China, Japan, and Corea. By John Henry Leech, B.A., F.L.S., F.Z.S., &c.—Part II. Family *Geometridæ*; Subfamilies *Œnochrominæ*, *Orthostixinæ*, *Larentiinæ*, *Acidaliinæ*, and *Geometrinæ*. (Plates VII. & VIII.) 228

Proceedings of the Geological Society 248

NUMBER CXVII.

Page

XXV. On the Genera and Species of Tropical African Arachnida of the Order *Solifugæ*, with Notes upon the Taxonomy and Habits of the Group. By R. I. Pocock, of the British Museum of Natural History 249

XXVI. Contributions from the New Mexico Biological Station.—No. II. (*continued*). On a Collection of Diptera from the Lowlands of the Rio Nautla, in the State of Vera Cruz. II. By C. H. Tyler Townsend, F.E.S. 272

XXVII. Two new Species of the Genus *Xanthospiloptera*, Wallengren. By W. J. Holland, LL.D., F.E.S., &c. 291

XXVIII. On a Collection of Fishes from the Island of Marajo, Brazil. By G. A. Boulenger, F.R.S. 294

XXIX. Descriptions of some new Species of Heterocera from Tropical America. By Herbert Druce, F.L.S. &c. 299

XXX. Description of a new Gymnotine Fish of the Genus *Sternopygus*. By G. A. Boulenger, F.R.S. 305

XXXI. On the Reptiles of Rotuma Island, Polynesia. By G. A. Boulenger, F.R.S. 306

XXXII. On two new Rodents from Van, Kurdistan. By Oldfield Thomas 308

XXXIII. On new Species of *Forficularia*. By Malcolm Burr, F.Z.S. 310

XXXIV. On a Collection of small Mammals from Uganda. By W. E. de Winton 316

XXXV. On a Collection of Rodents from Angola. By W. E. de Winton 320

XXXVI. On the Excretory Organs and Blood-vascular System of *Tetrastemma graecense*, Böhmig. By Dr. L. Böhmig, of Graz 324

A new case of Care of the Brood in Holothurians, by Prof. Hubert Ludwig, of Bonn 327

NUMBER CXVIII.

XXXVII. On the Cteniform Spiders of Ceylon, Burmah, and the Indian Archipelago, West and North of Wallace's Line; with Bibliography and List of those from Australasia, South and East of Wallace's Line. By F. O. Pickard Cambridge, B.A. (Plate IV.) 329

XXXVIII. On new Species of *Histeridæ*, and Notices of others. By G. Lewis, F.L.S. 356

Page

XXXIX. Note on some Reptiles and a Frog from Argentina. By Dr. A. Günther, F.R.S. 365

XL. Descriptions of six Pierine Butterflies of the Genus *Catasticta* in the Collection of the British Museum. By Arthur G. Butler, Ph.D. &c. 366

XLI. *Cicadidæ* from the Malay Archipelago. By W. L. Distant 369

XLII. A List of the Fishes obtained by Mr. J. Stanley Gardiner at Rotuma, South Pacific Ocean. By G. A. Boulenger, F.R.S. .. 371

XLIII. On some little-known Snakes from Natal. By G. A. Boulenger, F.R.S. 374

XLIV. Note on a new Antelope. By the Hon. Walter Rothschild 376

XLV. On the Dwarf Mungoose (*Helogale*) of Somaliland. By Oldfield Thomas 377

XLVI. The Nomenclature of some European Bats. By Gerrit S. Miller, Jr. 379

XLVII. A Revision of the Species of Butterflies belonging to the Genus *Teracolus*, Swains. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c. 385

New Books:—The Life-Histories of the British Marine Food-Fishes. By William Carmichael M'Intosh, F.R.S., Professor, and Arthur Thomas Masterman, Assistant Professor of Natural History in the University of St. Andrews.—Eggs of British Birds, with an Account of their Breeding-habits.—*Limicolæ*. By Frank Poynting.—Catalogus Mammalium, tam Viventium quam Fossilium. By Dr. E. S. Trouessart. Fasciculi I. and II.—The Geology of the English Lake District, with Notes on the Minerals. By J. Postlethwaite, F.G.S. 399-407

NUMBER CXIX.

XLVIII. On a Collection of Land-Shells from New Guinea. By Edgar A. Smith. (Plate IX.) 409

XLIX. Descriptions of new Fishes from the Mekran Coast, Persia. By G. A. Boulenger, F.R.S. 420

L. Descriptions of new Fishes from the Upper Congo.—II. By G. A. Boulenger, F.R.S. 422

LI. New Genera and Species of Millipedes of the Family *Platyrrhachidæ* from the Indo- and Austro-Malayan Subregions, contained in the Collection of the British Museum. By R. I. Pocock 427

LII. On two new Gammarids from New Zealand. By George M. Thomson, F.L.S. (Plate X.) 446

LIII. A Revision of the Species of Butterflies belonging to the Genus *Teracolus*, Swains. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c. 451

LIV. Phenomena of Autotomy observed in the Nymphs of *Monandroptera inuncans*, Serv., and *Rhaphiderus scabrosus*, Serv. By Edmond Bordage 473

LV. Phenomena of Autotomy in *Phasmidæ* belonging to the Genera *Monandroptera* and *Rhaphiderus*. By Edmond Bordage.. 475

LVI. Diagnosis of a new Subspecies of Gazelle from British East Africa. By Oldfield Thomas 479

New Books:—A Dictionary of Birds. By Alfred Newton, assisted by Hans Gadow; with Contributions from R. Lydekker, C. S. Roy, and R. W. Shufeldt.—Trouessart's 'Catalogus Mammalium.' Fasciculus III. ..... 479—482

Note on the Dates of "The Zoology of the 'Beagle,'" by C. Davies Sherborn; White Ants, with some Account of their Habits and Depredations, by Walter W. Froggatt, New South Wales Government Entomologist; Care of the Brood in *Psolus antarcticus*, by Prof. Hubert Ludwig, of Bonn ..... 483—487

NUMBER CXX.

LVII. Notes on *Sunaristes paguri*, Hesse, and some other rare Crustacea. By Thomas Scott, F.L.S., Naturalist to the Fishery Board for Scotland, and Andrew Scott, Fisheries Assistant, University College, Liverpool. (Plates XI. & XII.) 489

LVIII. A Revision of the Species of Butterflies belonging to the Genus *Teracolus*, Swains. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c. 495

LIX. On the Tetrameric Regeneration of the Tarsus in *Phasmidæ*. By Edmond Bordage 507

LX. New Insects from Embudo, New Mexico. By T. D. A. Cockerell, Entomologist of the New Mexico Agricultural Experiment Station 510

LXI. Descriptions of further new Species of Butterflies from the Pacific Islands. By H. Grose-Smith, B.A., F.E.S., F.Z.S. 515

LXII. On a Collection of Land and Freshwater Shells from Rotuma Island. By Edgar A. Smith 519

LXIII. Description of a new Snake from the Andes of Colombia. By G. A. Boulenger, F.R.S. 523

Page

LXIV. Descriptions of Two new Mammals from West Africa. By W. E. de Winton 523

LXV. On the Change and Form of the Teeth in the *Centetidæ*, a Malagasy Family of Insectivora. By C. I. Forsyth Major 525

LXVI. Descriptions of new Bats and Rodents from America. By Oldfield Thomas 544

LXVII. Description of a new *Scarabæus* from East Africa. By Charles O. Waterhouse, F.E.S. 553

New Book:—A Memoir of William Pengelly, of Torquay, F.R.S., Geologist, with a Selection from his Correspondence. Edited by his Daughter Hester Pengelly; with a Summary of his Scientific Work, by the Rev. Professor Bonney, F.R.S., F.G.S., Hon. Canon of Manchester 554

On a new Myxosporidian of the Family *Glugeidæ*, by Louis Léger.. 556

Index 558

PLATES IN VOL. XX.

Plate I. Bunodeopsis antilliensis and B. strumosa.
II. Morphology of the Montiporinæ.
III. New Annelids.
IV. New Cteniform Spiders.
V. Anatomy of Apera Burnupi.
VI. New Mollusca.
VII., VIII. Heterocera from China, Japan, and Corea.
IX. New Land-Shells from New Guinea.
X. New Gammarids from New Zealand.
XI., XII. Sunaristes paguri and Diaptomus laciniatus.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

"..... per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasi, Ecl. 1.

No. 115. JULY 1897.

I.—*The Actiniarian Family* Aliciidæ. By J. E. Duerden, A.R.C.Sc. (Lond.), Curator of the Museum of the Institute of Jamaica.

[Plate I.]

In a paper "On the Genus *Alicia*," published in this Journal (1895, xv. pp. 213–218), it was shown that an anatomical study of that genus and of the genus *Cystiactis* demanded their separation from the family Bunodidæ, where they had usually been placed, and the erection of a new family—Aliciidæ—for their reception.

The primary investigations were carried out upon *Alicia costæ*, Panc. (*A. mirabilis*, J. Y. Johnson, being the type of the genus), and upon *Cystiactis tuberculosa*, Quoy & Gaim. It was further suggested that the family might possibly include other genera, such as *Bunodeopsis*, of which but only a single species *B. strumosa*, Andr., was then known.

I have since been fortunate in obtaining, through the courtesy of Mr. J. Y. Johnson, of Madeira, an authentic specimen of his *A. mirabilis*, while removal to another hemisphere has brought me into contact with a second species of the genus *Bunodeopsis*; further, through the help of the Naples Biolo-

gical Station I have been enabled to compare the Jamaican species with the type, *B. strumosa*. Histological examination shows the first to agree very closely with the previously investigated *A. costæ*, and the two latter species confirm the original suggestion that the genus should be placed under the family Aliciidæ. A description of the three species studied is given below.

With a few unimportant alterations the family was defined as follows in the paper referred to:—

Family Aliciidæ.

Hexactiniæ with a large, flat, contractile base. Tentacles simple, subulate, and entacmæous. Column with simple or compound hollow outgrowths or vesicles over more or less of its surface, arranged mostly in vertical rows. No cinclides. Sphincter muscle endodermal and diffuse, variable in amount of development. Perfect mesenteries few or numerous. No acontia.

Besides the genera *Alicia* and *Cystiactis*, originally constituting the family, it is shown in a recently published paper by Prof. A. C. Haddon and myself (1896) that the genus *Thaumactis*, erected by Dr. G. H. Fowler (1889), is certainly a member of the family Aliciidæ, and now the previously doubtful genus *Bunodeopsis* is definitely included. The family thus consists of the genera *Alicia*, *Cystiactis*, *Bunodeopsis*, and *Thaumactis*.

Genus Alicia, J. Y. Johnson.

Actinia (pars), Dana, 1846.
Alicia, J. Y. Johnson, 1861.
Cladactis, Panceri, 1868.
Cladactis, Verrill, 1869.
Cladactis, Andres, 1883.
Alicia, Haddon and Shackleton, 1893.
Alicia, Duerden, 1895.
Alicia, Haddon and Duerden, 1896.

Tissues very delicate. Tentacles elongate, more or less retractile. Column long, beset nearly throughout with pedunculated or sessile, compound or simple vesicles; sphincter muscle feebly developed. Six pairs of perfect mesenteries, two pairs of which are directives.

The definition has been slightly modified, for purposes of comparison with the genus *Bunodeopsis*, from that given in 1895.

Alicia mirabilis, J. Y. Johnson.

Alicia mirabilis, Johnson, 1861, p. 303; 1862, p. 182.
Cladactis mirabilis, Andres, 1883, p. 443.

Form *.—Base very broad and usually adherent, capable of changing its position and of becoming free and floating upwardly at the surface of the water, may undergo great dilatation, undulate, much larger in diameter than the column, thin-walled and transparent, mesenterial lines form ridges and furrows, margin deeply crenate.

Column erect, somewhat cylindrical, enlarging above and below; beset, except towards the apex, with simple or branched pedunculated vesicular outgrowths of the cœlenteron, which, in contraction, entirely hide the column-wall, but in extension allow it to be seen; column-wall thin, pellucid, marked with slight longitudinal furrows corresponding with those on the base. Vesicles small proximally, nearly sessile, bear at their summit a single thickening or wart of hemispherical outline; become larger above, may have stalks half an inch high and three-tenths of an inch in diameter, which divide and redivide very closely into as many as sixty parts, each crowned with a wart; the appearance of the vesicles when half contracted bears some resemblance to a head of cauliflower or to a strawberry; capable of considerable contraction and inflation, but non-adherent.

Tentacles simple, entacmæous, numerous, subulate, elongate, rather slender, thin-walled, transparent, filamentous at apex, often coiled and overhanging, completely but not readily retractile, arranged in three (or four) rows near the margin of the disk, beset with minute urticating areas.

Disk slightly depressed or may be inflated, not larger than the diameter of the column, pellucid; twelve radiating furrows correspond with the six pairs of perfect mesenteries.

Mouth large; lips usually distended and divided by deep furrows into six longitudinal ribs on each side; no gonidial grooves distinguishable.

Colour.—Base uniformly pale brown or impure white; column very pale brown; peduncle of the vesicles mostly opaque white, but may be orange or a pale chestnut; warts on small appendages a dull purple or grey surrounded by a ring of white; apex sometimes divided by a white line into two grey areas or by cross-lines into four areas; disk pale

* The description of the external characters is founded upon those originally published by Mr. Johnson and upon notes accompanying his later specimen.

brown; œsophagus brown; tentacles brown, paler distally, minutely spotted with darker brown.

Dimensions.—Diameter of base 12 centim.; height and diameter of column when fully expanded 6·3 centim.; length of peduncle of largest vesicles 1·25 centim., diameter 0·8 centim.; mouth 1·25 centim. across.

The individual dissected was much contracted and flattened. Its length was 2·5 centim., the longer diameter of the base 1·5 centim., and the shorter 0·7 centim.

Locality.—Three specimens only have been obtained at Madeira by Mr. J. Y. Johnson. The first and finest was the one from which his original description was taken, and was said to have been obtained at a depth of a few fathoms from a fish-basket sunk in the Bay of Funchal. It was destroyed in an attempt to take it to England. A second was sent in spirit to the British Museum, and the third was very generously placed at my disposal by Mr. Johnson.

The specimen was much contracted and flattened, and the tentacles not infolded *. The vesicles were pressed against the column-wall. It was roughly triangular in outline, the lower part being much wider than the upper. The base was radiately and concentrically folded to a small degree, the margin being crenate. Although not in a good state of preservation for histological purposes, sufficient could be distinguished to allow of a determination of the most distinctive characters.

Activities.—The polyps frequently change their position in confinement and may even float base upwards. The upper part is generally in slow constant motion. The tentacles, usually more or less displayed, may be completely retracted. The urticating powers of the tentacles and vesicles are considerable. Specimens bear confinement well.

Column-wall.—The ectoderm is well developed in the capitular region and richly supplied with nematocysts; these are, however, of a different character from those in the

* The tentacles are evidently not readily infolded in most members of the genus. Verrill (1869, p. 472) likewise mentions that most of his specimens of *C. grandis* preserved in alcohol have the tentacles more or less extended and the disk exposed.

In a later paragraph of the same paper (p. 473) Verrill states that the *Anthopleura granulifera* of Duchassaing and Michelotti (*Actinia granulifera*, Les.) appears to belong to the genus *Cladactis* (*Alicia*), since it is said to be imperforate and tuberculated. I have lately obtained the species in abundance from Jamaican waters, and it may be here mentioned that an anatomical investigation shows it is an undoubted *Bunodes*, possessing a well-developed, circumscribed, endodermal muscle.

vesicles, being smaller and showing a long spiral thread coiled up inside. They are mostly limited to the upper naked part of the column. The mesoglœa is thrown into deep plaitings to support a strong endodermal muscle.

The vesicles have a broad ectoderm, which, in limited places, evidently corresponding with the thickenings at the tips, is crowded with enormous nematocysts rounded at each end. These are clear or contain granular matter, and have only a very short spiral thread; nearer the origin of the vesicles—that is, on the peduncle—they are smaller and have a long spiral thread as in the column-wall. Numerous strongly staining elongated bodies occur in the deeper part of the ectoderm, evidently developing nematocysts *. The mesoglœa is thin, and the endoderm, now decomposed, contains much granular pigment matter.

Sphincter muscle.—The sphincter muscle is of the same character as that found in *Alicia costæ*, i. e. endodermal, diffuse, and elongated. The plaitings of the mesoglœa are, however, better developed than in that species, becoming more dendriform and thinning out for some distance. The material does not admit of a determination of the exact limits of the muscle, but it appears to commence just below the tentacles and to extend into the region of the vesicles, being merely a concentration of the circular endodermal muscle occurring throughout the column-wall.

Tentacles.—The ectoderm of the tentacles is thick and richly supplied with nematocysts like those of the column-wall and arranged at right angles to and close to the surface. An occasional larger one, similar to the vesicular form, may be met with. The mesoglœa is broad, and forms small dendriform outgrowths on its internal border for the support of the strong circular endodermal muscle.

Œsophagus.—The ectoderm of the œsophagus is a deep layer and much folded. It contains numerous elongated stinging-cells and many large cells with pigmented granular contents, arranged in a nearly central zone.

The mesoglœa is narrow and supports a weak ectodermal and endodermal musculature.

Mesenteries.—Twenty-four pairs of mesenteries are present, similar in arrangement to those of *A. costæ*, viz.: six perfect pairs, two pairs being directives; six pairs forming a second cycle, alternating with the first; and twelve pairs in a third

* In the description of *A. costæ* it is stated ('Annals,' 1895, xv. p. 216) that the vesicles are not batteries of nematocysts. A re-examination of the sections in the light of other forms shows that they must be so regarded, the so-called gland-cells being developing stinging-cells.

cycle. They further resemble those of *A. costæ* in structure, especially in the form of the mesoglœal plaitings, which are, however, a little more pronounced in the present species. Mesenterial filaments are well developed, crowding the cœlenteron; abundant granules and large stinging-cells are in connexion with them. The endoderm of the mesenteries has small nematocysts.

Gonads.—No reproductive cells could be distinguished in the single specimen examined.

Genus Bunodeopsis, Andres.

Bunodeopsis, Andres, 1880.
Bunodeopsis, Andres, 1883.
Bunodeopis, Haddon and Duerden, 1896.

Tissues very delicate. Tentacles elongate, readily retractile. Column short, beset proximally with pedunculate or sessile vesicles, the vesicular area much broader than the capitulum. Sphincter muscle feebly developed. More than six pairs of perfect mesenteries.

The genus *Bunodeopsis* was established by Andres (1880) to include a form of which the distinguishing characters are that the column is short and thick, protruding here and there in hollow prominences, and with a collar developed like a capitulum. Previous to the present communication only one species—*B. strumosa*, Andr.—was known. Andres states that it closely resembles in appearance and habit the *Cystiactis Eugenia* of Duchassaing and Michelotti, found in the West Indies, differing from it only by the possession of the well-developed capitulum, and that whenever it is proved that this also possesses a similar capitulum, then the genus *Bunodeopsis* must be merged into *Cystiactis*, and its single species will become *Cystiactis strumosa*. The latter genus is thus defined by Milne-Edwards (1857, p. 276) :—"Corps entièrement couvert de tubercules subtentaculiformes ou offrant l'aspect de grosses phlyctènes très-saillantes." I was in hopes of rediscovering Duchassaing and Michelotti's *C. Eugenia* around Jamaica, but so far have not been successful, unless the present undoubted *Bunodeopsis* be the same as that meant by these two authors. Considering the close similarity which has been already ascertained to exist amongst the species of Actiniarians from the various West-Indian Islands, there is a little probability in this position; but when we compare the figure and description of *C. Eugenia* with that of *Bunodeopsis*, it seems far preferable to await further researches and for the present

to regard the two as distinct. It is not likely that the two distinguished zoophytologists would have neglected the elongated capitulum had it been present in their form.

Bunodeopsis antilliensis, sp. n. (Pl. I. figs. 1–4.)

Form (Pl. I. figs. 1, 2).—Base adherent, rarely free, irregular in outline, generally oval-shaped, thin-walled, and transparent, so that the mesenteries and internal organs can be seen through, margin crenate, surface thrown into ridges and grooves corresponding with the attachment of the perfect and imperfect mesenteries.

Proximal part of column covered with pedunculate irregularly arranged outgrowths or vesicles of various sizes communicating with the cœlenteron; most are large, compound, and shortly clavate, having a narrow peduncle; others are spheroidal or papillate; the larger may bear digitiform outgrowths, others are merely tuberculate, and others again have only thickened ridges. These may almost disappear when the vesicles are fully inflated, the surface being then nearly smooth, the ridges and tubercles showing as slightly thickened more opaque bands. The tubercles and bands on microscopic examination are seen to be batteries of large nematocysts. Column-wall expanded and short proximally, not readily seen owing to the presence of the abundant vesicles; upper part or capitulum only visible when the animal is extended, long, cylindrical, and smooth, much less in diameter than the vesicular area, but enlarging towards the disk; walls extremely thin throughout, pellucid, the darker coloured œsophagus clearly seen through.

Tentacles completely and readily retractile, elongate, smooth, entacmæous, subulate, thin-walled, transparent, variable in number, arranged in several cycles according to the formula 6, 6, 12, 24. Examples with 12, 18, 24, 30, 36, 48, and higher numbers are met with; outer arise directly from the margin of the disk; capable of great extension; overhang the column-wall; covered with minute urticating spots. In full extension they are very delicate structures, readily detaching when handled. Disk larger in diameter than the capitulum, very thin-walled, the attachment of the mesenteries showing through; peristome generally elevated into a cone with the oral aperture at the apex; mouth oval-shaped, six well-marked ridges and grooves on each side; no gonidial groove. The disk, tentacles, and naked portion of the column-wall are usually completely infolded, so that no external indication of them is left.

Colour.—The colour of the polyps when retracted is determined by that of the vesicles, and may be light blue or light brown; the vesicles, when not fully extended, are generally pale blue in colour, the thickened bands and papillæ a dull white, when inflated to their utmost are a pale brown. In extension the capitulum, tentacles, and disk are nearly colourless, but a slight brown tint can be distinguished; the column-wall in the vesicular region, as well as the pedal disk, is brown; the lips white.

Dimensions.—The dimensions are very variable, according to the state of retraction or extension. The diameter of the base may be as much as 3·5 centim.; an average diameter of specimens retracted in formalin is 1·8 centim.; height of retracted specimens about 0·5 centim.; length of extended inner tentacles 3·5 centim.; vesicles when inflated may be 0·7 centim. in diameter and 1 centim. in length.

Locality.—The species is met with sparingly throughout Kingston Harbour, Jamaica, attached to weeds in shallow water. Around the shores of the canal behind Port Royal, and at certain other places in the harbour, it occurs in abundance.

Activities.—The usual condition presented by the animal is that of a flattened extended group of bluish-white or pale brown vesicles towards the free end of elongated marine plants, such as *Thalassia*, to which the colours offer a marked contrast. The polyps are elongated along the length of the weed, or partially folded round it, and generally exhibit no appearance of disk, tentacles, or column-wall. They well bear out Andres's statement of resemblance to Nudibranchs. They occur near the surface in shallow water around the shores, and occasionally detach themselves and move to new positions, or, more rarely, may float on the surface of the water with the base upwards. Less commonly they are fully extended, the elongated tentacles in constant motion or gracefully overhanging. The vesicles are very changeable in size and appearance according to the amount of inflation; in the same polyp some may be inflated and others not at the same time; often they and the tentacles are quite limp. The urticating powers are considerable, being sufficient to pierce the skin of the hand. It is a very delicate and sensitive species, not bearing confinement well. An asexual method of reproduction is effected by the detachment of fragments of the body-wall from around the margin of the base and column.

Base (Pl. I. fig. 3).—The three layers of the base are clearly distinguishable. The nuclei of the ectoderm are arranged mostly in a narrow zone a little below the surface, the tissue nearer the mesoglœa not staining so deeply. The

latter layer is very thin. The endoderm is narrow and contains zooxanthellæ.

In several specimens sectionized the endoderm is divisible into two portions—a proximal, which is largely reticular in character, and a more internal part crowded with nuclei and zooxanthellæ (figs. 3, 4). The separation of this reticular layer, sometimes on the endodermal side and sometimes on the ectodermal side of the mesoglœa, is a well-marked feature of some examples and is found practically throughout the whole polyp. The reticulum appears to be formed of the nervous and perhaps muscular and mesoglœal elements, probably separated more distinctly by the unequal contraction of the mesoglœa and the two other layers, but is not a constant feature of the species, being evidently partly dependent upon the method of preservation. In vertical sections of the base the mesoglœa borders directly on the ectoderm, and the reticulum is on the endodermal side, whereas in the tentacles it is on the ectodermal side.

Column-wall.—The column-wall is very delicate and much broken up below by the outgrowths forming the vesicles. The nuclei in the ectoderm are uniformly distributed; nematocysts apparently do not occur, except a few, similar to those of the tentacles, in the capitulum. An ectodermal muscle on small mesoglœal plaitings can be distinguished. The mesoglœa is thicker than at the base and contains a few isolated cells. The endoderm has abundant nuclei and zooxanthellæ. The vesicles are hollow outgrowths of the body-wall, but their structure differs somewhat. The thickenings and tubercles seen externally are shown in sections to be batteries of nematocysts. The stinging-cells are very long, extending across the ectoderm, and are limited to the enlarged areas. Many cysts present a fine internal beaded character, due to the spiral thread seen in optical section, while others, mostly in the deeper parts, show no thread and may have the contents staining deeply, being evidently only in process of development. Small oval nuclei are, more particularly in the thickened regions, arranged in a narrow belt just below the surface. The remaining area is much vacuolated in places. The ectoderm of the vesicles where devoid of nematocysts is very thin. The mesoglœa is narrow. The endoderm contains zooxanthellæ, but not pigment granules such as are abundant in *A. costæ* and *A. mirabilis*. A slight endodermal muscle can be distinguished. In the difference in the characters of the nematocysts in the vesicles and those of the column-wall and tentacles *Bunodeopsis* agrees with the two species of *Alicia* examined. They are, however, larger in the latter genus.

Sphincter muscle.—The sphincter muscle is of the diffuse

endodermal type and weak. The muscle-cells line simple or slightly branched mesoglœal plaitings, which extend from a little below the base of the outermost tentacles to near the commencement of the vesicles, *i. e.* along the capitular portion of the column.

Tentacles (Pl. I. fig. 4).—The ectoderm of the tentacles is a thick layer, with numerous closely packed nematocysts, uniformly arranged in a zone at right angles to the surface. They are smaller than those in the vesicles, and all show the spiral thread distinctly. Below the nematocyst band is a zone of small nuclei. The ectodermal muscle-cells are strong and arranged on well-developed plaitings of the mesoglœa. The mesoglœa is thick compared with other regions. The endoderm has numerous zooxanthellæ, and an oblique muscle occurs on smaller mesoglœal plaitings. The endodermal cells vary much in length, the whole layer presenting a very irregular internal boundary. The portion figured is from one of the specimens showing an ectodermal reticular or nervous layer very distinctly.

Disk.—The disk is an extremely thin structure, showing no important characters.

Œsophagus.—The ectoderm of the œsophagus is much folded in both longitudinal and transverse sections, but no œsophageal groove is indicated. Abundant deeply staining nuclei are arranged a little below the surface. It is richly ciliated all round; medium-sized nematocysts crowd the layer, and pigment-granules occur in the deeper parts; a weak ectodermal muscle is present. The mesoglœa and endoderm are very thin, and not folded to the same degree as is the ectoderm. The endoderm contains many zooxanthellæ. A weak endodermal muscle is met with.

Mesenteries.—The mesenteries are in numerous pairs, but, owing to the flatness of the specimens when retracted and the crowded condition of the cœlenteron, their arrangement cannot always be readily made out. They are somewhat variable in number, and in the alternation of perfect and imperfect pairs. In one specimen eight pairs of perfect mesenteries were present, of which only one pair were directives. In another example twenty pairs were counted in the œsophageal region. The retractor muscle on the face of the mesenteries extends for some distance from the body-wall, and the mesoglœa is thrown into long narrow plaits to support it. The muscle extends completely round the smaller imperfect mesenteries. The mesenteries branch much below, nearly filling the cœlenteron. Mesenterial filaments, continuous with the ectoderm of the œsophagus and containing nematocysts,

occur at the termination of each branch; the endoderm becomes much thickened and contains granular matter.

Gonads.—In one specimen dissected developing ova were found in great numbers extending almost the whole length of the mesentery, and in places giving rise to considerable enlargements.

Bunodeopsis strumosa, Andres. (Pl. I. fig. 5.)

Bunodeopsis strumosa, Andres, 1880, p. 315.
Bunodeopsis strumosa, Andres, 1883, p. 444, pl. vi. fig. 1, pl. xiii. fig. 5.

*Form**.—Base adherent, usually large and oval, but variable in size and shape. Column short, delicate, very extensible, protruding here and there in irregular outgrowths or vesicles, the latter varying in size and simple or compound, apparently sessile, and having only very slight tubercular and annular superficial thickenings; capitulum much developed, smooth, delicate, regular, cylindrical, or caliciform. Disk medium, wider than capitulum, rounded, either flat, concave, or prominent, without gonidial marks. Tentacles retractile†, not very numerous (48), tricyclic, 12 [6, 6?], 12, 24, entacmæous, large, marginal, erect or bent outwardly, subulate, very flexible, covered with urticating spots. Peristome variable, with radiating lines; mouth sometimes with reversed lips, but not a special character; gonidial grooves wanting.

Colour. — Base whitish-brownish-yellow. Column yellowish, with yellow-brownish-ochre bands. Capitulum dirty white, uniform, transparent. Tentacles transparent, whitish. Peristome whitish.

Dimensions.—Small; basal diameter 1·5 to 2 centim.; length of tentacles 2 centim.

Locality.—Habitat on the leaves of *Cymodocea æquorea* (*Phycagrostis minor*), uprooted, floating on the surface, or else on *Posidonia*, *Zostera*, &c. Also on stones and rocks.

Varieties.—(*α*) *badia.* As above.

(*β*) *cana.* Entirely white; most frequently found on the shores of Lake Fusaro, Naples; more delicate and small.

Base.—The layers of the base are well developed, being much thicker than in the vesicular portion of the column-wall. The ectoderm is covered with a layer of short closely-set cilia; elongated nuclei are arranged in a narrow peripheral

* The description of the external characters is practically a translation of that given by Andres in 'Le Attinie.'

† A curious instance of extreme retraction was met with in one specimen; the tentacles had been withdrawn into the cœlenteron, and afterwards one was forced into the interior of a distended vesicle.

band, and rounded nuclei more sparingly in a broad zone below; circular or oval-shaped vacuolar spaces are present at intervals. The mesoglœa is thin. The endoderm bears zooxanthellæ and forms a weak muscle.

Column-wall.—The column-wall is extremely delicate in the region of the vesicles, but is thicker at the capitulum. The ectoderm in the latter is a regular even layer, showing elongated nuclei; the longitudinal muscle is developed on small mesoglœal foldings; nematocysts are not present, except near the vesicles. The mesoglœa is narrow and slightly folded both internally and externally; it thickens distally and becomes finely plaited to support the weak ectodermal muscle. The endoderm contains zooxanthellæ; the circular muscle is extremely weak.

The vesicles are very thin-walled, except at the parts corresponding with the opaque bands seen externally. The ectoderm is here thickened and shows abundant large nematocysts narrowing at each end. The spiral thread of the stinging-cells is not obvious. They are arranged mostly at right angles to the surface, but in places are longer than the ectoderm is broad, and become obliquely arranged. Different stages in their development are seen, the earlier ones staining deeply. The nuclei in the thickened areas are mostly in a narrow peripheral zone; elsewhere the ectoderm is a very thin layer devoid of nematocysts; oval or rounded vacuolar spaces are numerous. The mesoglœa is very thin. The endoderm is a narrow regular layer of cells containing abundant zooxanthellæ. A weak ectodermal and endodermal musculature is present.

Sphincter muscle (Pl. I. fig. 5).—The sphincter muscle is an extremely weak form of the diffuse endodermal type. It occurs in the capitular region as a slight concentration of the ordinary circular endodermal muscle-fibres. The mesoglœa is only a little plaited.

The sphincter is scarcely more strongly developed than the endodermal muscle of the tentacles or of the peripheral portion of the disk, and, except in position, is barely distinguishable from them.

Tentacles.—The nuclei in the tentacles are small and, in sections, more restricted to the periphery, where also a zone of long narrow nematocysts showing the spiral thread occurs, and occasionally much larger examples not exhibiting any spiral thread. A broad band of the ectoderm next the mesoglœa is nearly devoid of nuclei, and does not stain with carmine; a well-developed longitudinal ectodermal muscle is present. The mesoglœa is somewhat thick in places, and, with

the exception of an occasional isolated cell, is homogeneous in structure. It is plaited a little on both the ectodermal and endodermal borders for the support of the musculature. The endoderm-cells are often very long in section, the layer having irregular internal boundaries. Zooxanthellæ are present.

Disk.—The ectoderm is thick and ciliated; elongated nematocysts are present; the mesoglœa and endoderm are the same as in the tentacles. An endodermal musculature is seen.

Œsophagus.—The œsophageal walls are much folded, but there is no indication of any special groove; the ectoderm and endoderm are much thicker than the mesoglœa.

The ectoderm is richly ciliated, and, in addition to the outer zone of narrow nematocysts, contains abundant irregularly distributed large stinging-cysts. The nuclei are arranged in a broad zone; a very weak ectodermal muscle is seen in transverse sections, and a similar endodermal muscle in longitudinal sections.

Mesenteries.—In the region of the œsophagus twelve pairs of perfect mesenteries, including two pairs of directives, are present, and pairs of very short imperfect mesenteries alternate. They are broad towards the column-wall, but narrow towards the œsophagus; zooxanthellæ are sparingly present in the endoderm. The longitudinal retractor muscles are well developed for some distance on one side and the mesoglœa is thrown into supporting folds. Below the œsophagus the mesenteries branch, the endoderm becoming much thickened; each division is terminated by a rounded mesenterial filament bearing abundant nematocysts, and continuous with the ectoderm of the œsophagus.

Gonads.—No reproductive cells were present in any of the examples sectionized.

The distinctions between these two species are, in several respects, those of degree rather than of kind. Practically all the characters strongly marked in the first appear to be present in the second, but developed to a less extent. The average dimensions of the Antillean representative are two or three times those of the Mediterranean specimens received. Of a score of specimens received from Naples, preserved in 4 per cent. formalin, none exceeded 0·4 centim. in diameter across the base, while an average diameter of the Jamaican forms is 1·3 centim. The colour distinctions may be of some moment. The column in Andres's species has yellowish-brown-ochre bands; these are never met with in the new

species. In this latter the vesicles, when not fully inflated, usually have a bluish tinge, not noticed in the former.

It seems likely that the specimens received by me are the var. *cana*, which is white, more delicate, and smaller than the var. *badia*.

The vesicles appear sessile in *B. strumosa*, and do not exhibit pronounced tubercles or digitiform processes. Similar microscopic elements, however, are present in both. Again, the musculature of the two is developed along the same lines; but, whereas in *strumosa* the mesogloea is only folded or very slightly plaited for its support, in *antilliensis* the plaits are comparatively large and numerous. In minute histological details, such as the forms of the stinging-cysts and the structure of the body-wall, they resemble one another.

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References.

1846.—Dana, J. D. "Report on Zoophytes." U.S. Explor. Exped. 1838–1842. Philadelphia.

1857.—Milne-Edwards, H. "Histoire naturelle des Coralliaires, ou Polypes proprement dits." I. Paris.

1861.—Johnson, J. Y. "Notes on the Sea-Anemones of Madeira, with Descriptions of new Species." Proc. Zool. Soc.; Ann. & Mag. Nat. Hist. (3) ix. (1862).

1864.—Duchassaing, P., and Michelotti, J. "Supplément au Mémoire sur les Coralliaires des Antilles." Mem. Reale Accad. Sci. Turin, (2) xxiii.

1868.—Panceri, P. "Nuovo genere di polipi *Actiniari* (*Cladactis*)." Rend. d. R. Accad. d. Sc. Napoli.

1869.—Verrill, A. E. "Notes on Radiata.—Review of the Corals and Polyps of the West Coast of America." Trans. Connect. Acad. i. (1868–1870).

1880.—Andres, A. "Prod. neapol. actin. faunæ." Mitt. zool. Stat. Neapel, ii.

1883.—Andres, A. "Le Attinie." Att. del. R. Accad. d. Lincei, xiv.

1889.—Fowler, G. H. "Two new Types of *Actiniaria*." Quart. Journ. Micr. Sc. xxix.

1893.—Haddon, A. C., and Shackleton, A. M. "Description of some new Species of *Actiniaria* from Torres Straits." Proc. Roy. Dubl. Soc. vol. viii. (n. s.) part i.

1895.—Duerden, J. E. "On the Genus *Alicia* (*Cladactis*), with an Anatomical Description of *A. costæ*, Panc." Ann. & Mag. Nat. Hist. (6) xv.

1896.—Haddon, A. C., and Duerden, J. E. "On some *Actiniaria* from Australia and other Districts." Trans. Roy. Dubl. Soc. vol. vi. ser. 2.

EXPLANATION OF PLATE I.

Reference letters.

div. Partial division between the cœlenteron and the tentacular cavity.
ect. Ectoderm.
ect.m. Ectodermal muscle.
end. Endoderm.
mes. Mesogloea.
nem. Nematocysts.
nuc. Nuclei.
r.lay. Reticular or nervous layer.
sph.m. Sphincter muscle.
ten. Tentacle.
zoox. Zooxanthellæ.

Fig. 1. *Bunodeopsis antilliensis*, sp. n. Expanded polyp, nat. size. 1 *a*, 1 *b*, 1 *c*, 1 *d*. Vesicles.
Fig. 2. Ditto. Retracted polyp, nat. size.
Fig. 3. Ditto. Vertical section through a portion of the base, × 200.
Fig. 4. Ditto. Transverse section through a portion of a tentacle, × 200.
Fig. 5. *Bunodeopsis strumosa*, Andres. Vertical section through capitulum and a portion of one side of a tentacle, × 200.

Biological Laboratory,
Museum, Institute of Jamaica,
Kingston,
March 29, 1897.

II.—*On a Collection of Heterocera made in the Transvaal.*

By W. L. Distant.

Fam. Zygænidæ.

Species obtained in the Transvaal.

Neurosymploca agria, Dist. Pretoria.
—— *concinna*, Dalm. Pretoria.
Zutulba Zelleri, Wallengr. Zoutpansberg.
Crameria clœckneria, Stoll. Pretoria.
Syntomis Kuhlweinii, Lef. Zoutpansberg (*Kæssner*),
—— *sirius*, sp. n. Pienaars River (*W. L. D.*), Zoutpansberg (*Kæssner*).
—— *Rendalli*, sp. n. Barberton (*Dr. P. Rendall*).
Parasyntomis æthiops, sp. n. Zoutpansberg (*Kæssner*).
Thyretes caffra, Wallengr. Pretoria.
Eressa fulvescens, Walk. Pretoria, Zoutpansberg.
Euchromia africana, Butl. Pretoria.

Species obtained in Natal.

Zutulba ampla, Walk. Durban.
Syntomis Kuhlweinii, Lef. Durban.
Euchromia africana, Butl. Durban.
—— *Folletii*, Gray. Durban.

Unless otherwise specified, the captures were my own.

Syntomis sirius, sp. n.

Body, legs, and antennæ black.

Wings black; anterior wings with five large white spots, situate, one in cell, and one beneath it, one at extremity of cell, and two close together beneath extremity of cell; posterior wings with a large basal ochraceous spot, between which and apex is a smaller white spot.

Exp. wings 20–21 millim.

Hab. Transvaal, Pienaars River (*Distant*), Zoutpansberg (*Kæssner*).

Syntomis Rendalli, sp. n.

Body, legs, and antennæ black; pronotum with the humeral margins white; a lateral spot on both the meso- and metasternum, a series of lateral abdominal spots, and two dorsal abdominal spots—one at base and the other at about one third from apex—white.

Wings black or brownish black: anterior wings with six white spots, of which the first is smaller and subbasal, second in cell, and third beneath and a little before it, fourth near end of cell, fifth and sixth contiguous a little beneath and beyond lower extremity of cell; posterior wings with two white spots, the first largest and near base, the second smaller and discal.

Exp. wings 20–22 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

From the description of *S. caryocatactes*, Wallengr., that species appears to be the nearest allied to *S. Rendalli*. The one I now describe may be distinguished from Wallengren's species by the sternal spots, the second abdominal dorsal spot, somewhat smaller size, &c.

Parasyntomis ? æthiops, sp. n.

Body, antennæ, and legs black; proboscis and apex of abdomen ochraceous.

Wings black: anterior wings with two whitish spots, one in and near end of cell, and the other almost immediately beneath it; posterior wings with the basal abdominal area pale hyaline divided by the dark veins.

Exp. wings 30 millim.

Hab. Transvaal, Zoutpansberg (*Kæssner*).

I am informed by Sir G. F. Hampson, who has examined my typical specimen, that the species may be placed provisionally in his MS. genus *Parasyntomis*, from which it differs by having the veins 7, 8, 9, 10, 11 from cell, instead of 8, 9, 10 stalked.

Pyralidæ.

I take this opportunity to describe a very beautiful species belonging to this group of Moths, which may for the present be placed in the genus *Macna*, from which it differs by the shorter palpi and the rounded outer margins of the anterior wings.

Macna Hampsoni, sp. n.

Body, antennæ, and legs purplish brown; head above, a large central triangular spot to pronotum, basal segment of abdomen, and a spot at anterior coxæ pale olivaceous green.

Anterior wings pale olivaceous green, with the base, a large patch on inner margin reaching cell and connected with costa by a narrow and much-waved fascia, outer margin preceded by a linear waved fascia, purplish brown; the inner patch contains two pale olivaceous spots. Posterior wings purplish brown, with a transverse series of pale olivaceous spots extending about one third across wing from abdominal margin, and a more obscure spot nearer base. Wings beneath purplish brown: anterior wings with a large subtriangular apical pale olivaceous patch; posterior wings as above, with a small darker discal spot.

Exp. wings 50 millim.

Hab. Transvaal, Barberton District.

III.—Cicadidæ *from the North Chin Hills, Burma.*

By W. L. Distant.

I am indebted to the kindness of Capt. E. Y. Watson, of the Indian Staff Corps, for a small collection of these Homoptera made at the above little-visited and less entomologically worked locality. The specimens had been awaiting my return from South Africa for two or three years, which, I regret to say, had not improved their condition, and made them very difficult to set out. However, I was able to identify them, and the following is a list of the species:—

Pœcilopsaltria Watsoni, sp. n.
Cosmopsaltria radha, *Dist.*
—— velitaris, sp. n.
Pomponia evanescens, *Walk.*
Pomponia cuneata, sp. n.
Terpnosia maculipes, *Walk.*
Calcagninus marginatus, sp. n.

Terpnosia maculipes is a very rare species in collections. The type in the British Museum was collected in "N. Bengal"

by Miss Campbell. *Calcagninus marginatus* is the third described species of the genus, and, as the other two were received from the Neelgiri Hills, *Calcagninus* may prove to be a mountain genus.

Pœcilopsaltria Watsoni, sp. n.

♀. Head, pronotum, and mesonotum brownish ochraceous; head with a transverse margin to front, a spot above base of antennæ, the area of the ocelli, and a transverse fascia connecting same with eyes black; pronotum with the incisures and two central fasciæ directed outwardly towards anterior margin black; mesonotum with four obconical spots on anterior margin, the central two shortest; a lanceolate central discal fascia and a small spot in front of each anterior angle of the basal cruciform elevation black. Abdomen thickly covered with yellowish pile, the segments blackish at base and pale ochraceous at apical margins; a faint longitudinal central black fascia, broadest at base. Sternum and legs brownish ochraceous; face with a central longitudinal black fascia; abdomen beneath without the yellowish pile.

Tegmina talc-like and obscure creamy white, brownish at base, and with three irregular brown transverse fasciæ enclosing rounded creamy spots, the first crossing radial area, the second just beyond radial area, and the third at junction of apical and ulnar areas; a double row of outer marginal spots situate on the longitudinal veins of apical areas. Wings stramineous, the apical margin and a transverse fascia before apex dark castaneous: these castaneous markings enclose a large subapical stramineous spot.

The rostrum reaches the apex of the second abdominal segment.

Long. excl. tegm., ♀ 22 millim.; exp. tegm. 62 millim.

Allied to *P. hilpa*, Walk.

Cosmopsaltria velitaris, sp. n.

In colour and markings very closely allied to *C. nicomache*, Walk., but larger, and differing also from that species by the greater length of the rostrum, which considerably passes the posterior coxæ, and not only just extending beyond their apex as in Walker's species; the abdomen also is longer and the opercula proportionally to same being much shorter. The principal colour difference is in the dorsal surface of the abdomen, which is more castaneous and less black.

Long. excl. tegm., ♂ 27 millim.; exp. tegm. 80 millim.

C. nicomache appears to be confined to North-east Continental India, and the species here described is its near Burmese congener.

Pomponia cuneata, sp. n.

Head black, some marginal testaceous streaks to front and the same at base; eyes brownish ochraceous; pronotum ochraceous, with two central longitudinal fasciæ and the incisures black; two castaneous spots on outer basal margin; mesonotum ochraceous, with a central fascia, four obconical spots—the outermost largest—and a spot in front of each anterior angle of the basal cruciform elevation black; abdomen above castaneous, the three basal segments posteriorly narrowly ochraceous at the lateral margins. Sternum and opercula pale ochraceous; face, legs, and abdomen beneath brownish ochraceous.

Tegmina and wings pale hyaline, the venation either ochraceous or castaneous, the tegmina with the transverse veins at the bases of the second and third apical areas darkly infuscated.

The opercula are somewhat acutely triangular, their narrowed apex reaching the second abdominal segment; the rostrum just passes the apex of the intermediate coxæ.

Long. excl. tegm. 25 millim.; exp. tegm. 66 millim.

This species may be placed near *P. scitula*, Dist.

Calcagninus marginatus, sp. n.

Body and legs ochraceous; apex of the abdomen black.

Tegmina pale ochraceous hyaline, the outer margin somewhat broadly infuscated. Wings paler hyaline, their apical margins narrowly and obscurely infuscated.

Opercula short, subquadrangular; rostrum about reaching the base of the posterior coxæ.

Long. excl. tegm. 15 millim.; exp. tegm. 38 millim.

IV.—*Contributions from the New Mexico Biological Station.* —No II. (continued). *On a Collection of Diptera from the Lowlands of the Rio Nautla, in the State of Vera Cruz.* II.* By C. H. Tyler Townsend, F.E.S.

Psychodidæ.

23. *Psychoda punctatella*, sp. n.

One male, Paso de Telaya, March 30.

Length 1 millim., of wing 1·5 millim.

* Section I. appeared in Ann. & Mag. Nat. Hist. ser. 6, vol. xix pp. 16–34.

A very distinct species, which approaches in structure *P. angustipennis*, Will. (Dipt. St. Vincent, p. 284), but the wings, while quite as narrow, are not so acutely pointed at tip. Brownish or greyish brown, the thorax clothed with a thick tuft of white hair. A smaller thick tuft of white hair at base of abdomen; rest of abdomen with short hair, appearing brownish when viewed from above and white when viewed obliquely. Head with some blackish hair. Legs greyish brown. Wings nearly three times as long as greatest width, quite thickly clothed with white or yellowish-white hair, forming a thick fringe on border, which is of even and only moderate length on whole anterior border of wing, but grows gradually longer from tip to base on posterior margin, until at base it lacks but little of being as long as greatest width of wing. The hairs of this longest fringe are directed straight backward at a right angle to long axis of wing. Eight small black spots on margin of wing as follows:—One on front margin at extreme base; two faint linear central ones on base of wing, indistinctly separated; a large elongate one opposite on inner margin; two smaller distinct ones opposite each other on margin, one on front, the other on hind margin a little beyond middle of wing; a somewhat less distinct one on extreme tip, and a still less distinct one on hind margin between the apical one and the middle hind-marginal one. The wing-spots are seen with the compound microscope to touch only the veins, the basal spots appearing as a basal fascia to the wing. Outline of the wing bilaterally symmetrical, not elongate-pointed at tip, but the margins evenly curved on each side to meet in an acute angle, the curves of apical portion being nearly the same as those of basal portion. Antennæ much longer than thorax, reaching to or beyond middle of abdomen, comparatively stout, thickly clothed with white hair.

This species seems allied to the European *P. albipennis*, Zett., the description of which is strikingly similar in some points. But *punctatella* differs abundantly, not only in other characters but particularly in the spotted wings, the wings of *albipennis* being without spots. It may belong in the *albipennis* group, as would seem to be indicated by the description of the latter in the characters of the elongate antennæ, elongate wings, hair and fringe of wings, small size, and general coloration.—I may mention here that I have identified *P. albipunctata*, Will., in specimens taken at Frontera, Tabasco.

Rhyphidæ.

24. *Olbiogaster tæniatus*, Bell.

Rhyphus tæniatus, Bellardi, Sagg. Ditt. Mess. Append. p. 5, pl. fig. 15.

One male, San Rafael, June 26. In sweepings.

Length about 7½ millim., measuring the curve of the abdomen.

Agrees perfectly with Bellardi's description and figure, except that the middle femora are mostly yellowish. It also agrees perfectly with Osten Sacken's description of the genus *Olbiogaster*, and bears out his remarks on the genus at the end of the description (see Biol. C.-A., Dipt. i. pp. 20–21). Osten Sacken has there pointed out that *R. tæniatus*, Bell., is an *Olbiogaster*. This is the first record of the finding of this species since Bellardi described it in 1862.

This very curious dipteron exactly resembles at first sight some of the smaller Hymenoptera, the general form, aided by the markings of the abdomen and the long slender antennæ, giving the appearance presented by some of the small Ichneumonidæ.

Tabanidæ.

25. *Tabanus mexicanus*, var. *limonus*, n. var.

One male, on flowers of the *Cordia* sp., San Rafael, July 17.

Length 11½ millim., not including antennæ; wing 10 millim.

Entirely of a tawny lemon-yellow colour, including the narrow costa of wings on basal two thirds. Eyes in life wholly pale yellowish olive, abruptly more glassy on lower one third; in the dried specimen rich brown. Antennæ, palpi, and legs with a slightly deepened tawny tinge. Second antennal joint one half as long as first; first as long as its apical breadth; second shorter than wide, with an anteriorly-directed apical spur on upper edge; third joint about twice as long as first and second together, with a well-marked acute process on base above, the process ending in an acute angle but not produced; this process makes the basal width of joint about one third greater than width of first and second joints. Annulate portion of third joint rather slender and pointed. Face, palpi, breast, thorax, trochanters, and abdomen rather thickly clothed with brassy-yellow hair, that on the thorax and breast being longest and that on abdomen the shortest, the hinder two thirds of abdomen being rather sparsely clothed above. Tarsi and ends of tibiæ slightly tinged with brownish, most pronounced on tips of tarsi. Proboscis tinged with

brown, the labella shining dark brown. Face, thorax, and scutellum brassy-yellow pollinose; abdomen shining tawny yellow, the apical portion (in the dried specimen) slightly tinged with brownish, but yellow in life. Knobs of halteres greenish yellow. Eyes bare, contiguous from the small tubercle-like yellow vertex to near base of antennæ, leaving a small, bare, brassy-yellow pollinose frontal triangle, the upper angle abruptly tapered and acute. Anterior branch of third vein with a long stump at its basal angle, the stump being three times or more the length of basal section of branch. Wings, except costal border above mentioned, pure hyaline, wholly without sign of spots; veins yellow. The yellow of costa reaches from the elongate slightly oblique stigma, which is more deeply yellow, to base of wing, filling out the portion basad of the basal cells with a tinge of the yellow. Posterior cells all open, none of them narrowed, except that fourth is narrowed a little on border from its greatest width in middle. Difference in size of facets of eye marked, abrupt; the small facets extend up to a little short of the anterior or inner angle of eye, but the line of separation extends backward from this point at a slight upward angle off the horizontal. In life this specimen had little of the green tinge, except on the eyes as described.

I give this full description of this very handsome variety of a well-known species, because existing descriptions of the species are lacking in detail. The points of difference between this variety and the typical form, as well as several other varieties of *mexicanus*, are given in the table below.

A considerable number of forms of this group have been described by various early authors—Fabricius, Meigen, De Geer, Beauvois, Macquart, and Walker—and classed as synonyms of *mexicanus* (see Osten Sacken, Cat. p. 59). The typical form has the wings spotted with brown. Only one of the others has the wings absolutely unspotted, namely, *inanis*, Fabr., which I consider a good variety on this character. It is at once distinguished from *limonus* by the tomentum being wholly cinereous instead of yellow. These forms should be separated as follows:—

Table of Tabanus mexicanus *and Varieties.*

1.	Wings spotted	2.
	Wings wholly without spots	4.
2.	Spots only on cross-veins and bifurcation of third vein	3.
	Spots also on margin of wing at ends of longitudinal veins	*olivaceus*, De G. (S. America.)

3. Tomentum yellow or greenish yellow	*mexicanus*, L. Typ. form. (Mexico, Florida, &c.)
Tomentum cinereous	*punctatus*, Fabr. (Cayenne.)
4. Tomentum yellow to lemon or greenish yellow	*limonus*, Towns. (Mexico.)
Tomentum cinereous	*inanis*, Fabr.

Bellardi described the female of var. *limonus* (Ditt. Mess. i. p. 59), but gave it no distinctive name. The *mexicanus* group will be distinguished from *T. luteoflavus*, Bell., and the group of *T. fulvus*, Meig. (Europe), by the process of third antennal joint being only moderately developed, not deeply excised and strongly angulate as in *T. luteoflavus*.

Asilidæ.

26. *Leptogaster pictipes*, Loew.

One female, San Rafael, June 21. In sweepings.

Length 7 millim.

I am quite confident that this is the same species as the male specimen described by Loew from Illinois. Loew's *L. varipes*, described from a female specimen, is doubtless the same species, probably not even constituting a variety. Both are very similar to *L. cubensis*, Bigot, but, I believe, distinct from the latter in the colouring of the legs (see von Roeder, Dipt. Porto Rico, Stett. ent. Zeit. 1885, p. 340). Yet it is quite possible that *pictipes* may have to be considered but a variety of *cubensis*.

In my specimen the antennæ are blackish, the knob of halteres as well as stalk yellowish, and the posterior femora whitish on proximal two thirds, with all the metatarsi whitish. The wings are almost insensibly tinged with fuscous.

The species from Durango, mentioned by Osten Sacken in the 'Biol. C.-A., Dipt.' (i. p. 167), is probably *pictipes* or a variety of it peculiar to the tableland.

Syrphidæ.

Nausigaster.

In Section I. of this paper I described as new a neotropical species of this genus, *N. meridionalis*, Towns. (no. 5), long suspected to be distinct, but not heretofore separated from *N. punctulata*, Will. Since then I have taken further specimens of this genus in New Mexico and Texas, in the latter case securing abundant material. From a careful study of this material I am convinced that there are several distinct

species of *Nausigaster* occurring in North America, three of which Dr. Williston had before him when writing his 'Synopsis of Syrphidæ.' These are mentioned on pages 21–22 under the name of *N. punctulata*. Dr. Williston has been loth to separate the forms as distinct, on the picture of the wings alone; but when material from several widely separated localities shows a constant pattern for each locality, supplemented by differences in the thoracic vittæ, I think they may properly be separated and accepted as good species. In connection with *N. meridionalis* from the Rio Nautla, therefore, I wish to present here the following notes on the separation of the forms of *Nausigaster*, although three of the species concerned belong to the fauna of Texas, New Mexico, and California.

The single female from New Mexico, from which Williston's description of *punctulata* was drawn, is the only specimen of that species so far recorded. I have seen another from Rincon, N.M., taken by Cockerell on flowers of *Chilopsis linearis* (Cav.), DC., July 5, which agrees with Williston's description in the wing picture.

The five males from California, together with the additional males and females from the same place (see Will., Synop.), constitute another well-marked species, the specimens all agreeing with each other. For this species I propose the name *unimaculata*. It is distinguished by the single spot of the wings and the five thoracic vittæ.

The male from the Isthmus of Tehuantepec forms a third species, which I have considered to be the same as *meridionalis*. It should be stated that I have not seen the Tehuantepec specimen nor the Brazilian specimens referred by Williston to the same species, but that I refer them to *meridionalis* on the statements of Williston regarding the picture of the wings.

A fourth species from Texas I describe below. These four species may be separated as follows:—

Table of Species of Nausigaster.

1. A single spot on the wings; five thoracic vittæ	*unimaculata*, sp. n. (California.)
Two spots on the wings, the spots not confluent; only two thoracic vittæ	*punctulata*, Will. (New Mexico.)
The two wing-spots confluent, forming a more or less well-defined and extensive picture; four thoracic vittæ. (Lowlands of Texas to Brazil.)	2.

2. The second basal cell mostly filled with the picture ..... *meridionalis*, Towns.
(Vera Cruz, Tehuantepec, Brazil.)
The second basal cell almost wholly hyaline .. *geminata*, sp. n.
(Texas lowlands.)

27. *Nausigaster geminata*, sp. n.

Twenty-seven specimens, male and female, Beeville and Kenedy, Texas. All taken on flowers of *Parthenium hysterophorus*, L. (det. Wooton), August 30 to Sept. 14.

Length 5 to 6 millim. (rarely 7 millim., female), the male being the smaller.

Differs from Williston's description of *punctulata*, female (Syn. pp. 21–22), as follows:—On mesonotum there are four distinct less pollinose stripes. There is also the beginning of a narrower one just above base of wings. The two median ones are narrowly separated, and sometimes appear as one owing to the effacing of the pollinose line which normally separates them. Lower part of face same colour as antennæ (yellowish red), only a shade or two lighter. The two black spots of wing are united, filling all of submarginal cell except distal end. There is also a blackish cloud on the cross-veins at distal end of second basal cell, and a slightly yellowish infuscation in first and second costal cells and base of marginal cell. Legs are yellowish red; femora as in *punctulata*; tarsi all more or less brownish, especially hind pair. Scutellum in both sexes, and abdomen in male, more or less tinged with yellowish red (fresh specimens).

Described from 20 males and 7 females, as follows:—Beeville, Texas, 1 male and 1 female, Aug. 30; 3 males and 2 females, Aug. 31: Kenedy, Texas, 1 female, Sept. 11; and 16 males and 3 females, Sept. 14. These numerous specimens are all constant in the wing picture, with the single exception of the female taken Sept. 11, in which the two spots are very faintly but still perceptibly united. The second basal cell in all shows a tendency toward a very slight fuscous-yellow tinge, but is not enough to appreciably affect its hyaline appearance when held up to the light. Only two of the specimens (both females) measure 7 millim., the others all being from 5 to 6 millim. This species differs from *meridionalis* not only in the less extensive picture of the wings, but in the smaller size, the very distinct thoracic vittæ, &c.

Volucellas of the amethystina *Group.*

There are six species of *Volucella*, taken on the flowers of the *Cordia* sp. at San Rafael, which by their general metallic

colouring and closely similar form show that they all belong, with one exception, to the same group. One of them possesses no prescutellar row of bristles, and further differs in being pronounced metallic green including head, with coppery on abdomen and showing but little if any violet. It inclines to the *obesa* group. The others belong to the group of *V. amethystina*, Bigot, which also includes *comastes*, Will., *chætophora*, Will., &c. To the last-named species I refer one of the six above mentioned, while the other five are new. These species may be distinguished by the following table. They are all distinct from *Volucella*, n. sp. ?, Will., Synop. p. 150.

1. No prescutellar row of bristles present; thorax and scutellum bright metallic green; abdomen coppery	*viridana*, sp. n.
Prescutellar row of bristles present; metallic colouring bluish, dark green, or violet	2.
2. Wings hyaline, with only a milk tinge in oblique lights	*chætophora*, Will.
Wings strongly shaded with brown and yellowish	3.
3. Scutellum metallic, nearly or quite the colour of the thorax	4.
Scutellum wholly (dull or clear) brownish yellow, contrasted in colour with the thorax; face and cheeks with stripes	5.
4. Face and cheeks without stripes, abdomen without yellow	*opalina*, sp. n.
Face and cheeks with pronounced stripes; abdomen yellow at base	*rafaelana*, sp. n.
5. Second abdominal segment in most part the same colour as the scutellum; rest of abdomen without yellowish or with but a trace on anterior corners of third segment	*cordiæ*, sp. n.
Second and third abdominal segments same colour as scutellum in a nearly equal subtriangular patch on anterior corners, with a smaller patch usually distinct on anterior corners of fourth	*nautlana*, sp. n.

I have no specimens of *amethystina*, Big., and therefore do not include it in the table. It is described by Bigot as having the scutellum the same metallic violet as the thorax, the cheeks with a stripe, but facial stripe apparently absent, and with differences in the abdomen and wings which preclude my referring any of the present species to it. It may be added that all of these species have the second vein regular and the margin of scutellum with bristles.

28. *Volucella chætophora*, Will.

Two females, San Rafael, July 7 and 10. On flowers of the *Cordia* sp.

Length 9 and 12 millim.

I cannot separate these two specimens satisfactorily. The larger one has no whitish hair on front, while the other has the hair of front all whitish except at vertex. I cannot believe that these differences are of specific value in this case, though they may be considered varietal. Without more specimens of both forms, however, I hesitate to define the variety. The larger specimen also seems to differ in the wings being more distinctly dilute brownish at base. The third antennal joint in the larger one is a little longer and more abruptly narrowed on middle.

The specimens differ but little from Williston's description of *chætophora* (Syn. pp. 149–150, and Biol. C.-A., Dipt. iii. p. 52). I should call the third antennal joint somewhat emarginate. The antennæ are brownish yellow, with most of third joint brown. Two median vittæ on thorax are conspicuous by the hair being darker, subappressed, and directed backward, while the rest is white, suberect, and directed a little forward. Scutellum with coppery reflections; thorax with only blue, green, and purple reflections. Legs black. Abdomen bluish black; the anterior half of segments 3 to 5, above and below, with white pubescence, the posterior half with black. This is even to be noticed on the sixth segment in the larger specimen.

29. *Volucella cordiæ*, sp. n.

Fourteen female specimens, San Rafael, June 30 to July 13. All on flowers of the *Cordia* sp.

Length 9 to 12 millim.

Thorax behind with a prescutellar row of bristles. Wings fuscous brown on outer distal half, becoming dilute fuscous toward internal border extending to alula, yellowish on basal portion. Scutellum wholly clear brownish yellow, second abdominal segment same, except narrow hind border and wide median vitta; rest of abdomen metallic purplish black, with blue, green, and violet reflections. In some specimens there is a faint yellow shade, more or less distinct, on anterior corners of third segment. Anterior half or less of fourth segment, anterior third or more of third segment, and anterior two-thirds of second segment with short white pubescence; rest of abdomen with black pubescence. Venter with about same proportions of white and black hair, but longer, with hair of second segment nearly all white. Face and cheeks with well-developed stripes, but facial stripe usually narrower than that of cheeks. Legs black or brown, paler at knees and tips of tibiæ. Antennæ pale brown; third joint narrowed

on apical third to about half its basal width. Arista longer than antennæ, thickly plumose. Face brownish yellow, silvery pollinose on sides, black-hairy on region of tubercle, with some white hairs on sides. Front shining greenish black, with yellowish hair except some black at vertex, yellowish pollinose on each side in front, with a black patch next antennæ in middle. Thorax dark bluish or greenish, with coppery or violet reflections and more or less of a milky tone over all, this tone sometimes wanting, leaving the disk shining dark green; clothed with quite thick, short, yellow, anteriorly-directed pubescence; a pair of median vittæ, more distinct in front, formed by longer finer pubescence directed backward. Pleuræ with yellow hairs. Six strong bristles on scutellum, apical pair rather distant, also a smaller bristle on each side near anterior corners. In some specimens there are four nearly equal bristles on each side beside the weaker one. Scutellum clothed with yellow hair, with some rather inconspicuous black hairs on posterior half of dorsum.

30. *Volucella rafaelana*, sp. n.

One female, San Rafael, July 1. On flowers of the *Cordia* sp.

Length 11 millim.

Differs from *V. cordiæ* as follows:—Scutellum without yellow, wholly opalescent-cupreous with a faint bluish-milky tinge like that of thorax. Scutellum with black hair on disk, yellow hair confined to the edges. Third abdominal segment laterally pale yellow on anterior margin. Wings nearly hyaline basally instead of yellow, and less fuscous on internal border, with the first and second posterior cells largely hyaline.

This is at least a good variety of *cordiæ*, if not distinct as a species.

31. *Volucella nautlana*, sp. n.

Six males, San Rafael, June 28 to July 7. All on flowers of the *Cordia* sp.

Length 10 to 11 millim.

Differs from *V. cordiæ* as follows:—Antennæ somewhat shorter, third joint proportionately not so much narrowed. Frontal triangle black, shining anteriorly in middle, a little yellow-pollinose on sides, with thick black hair. Thorax with the longer posteriorly-directed hairs black, thickly clothing whole dorsum, seen above the shorter anteriorly-directed thick golden-yellow vestiture. Scutellum not so clear brownish yellow, more of a flesh tinge, with a slightly

opalescent cupreous reflection, but still entirely contrasted in colour with the thorax; clothed with yellow hair only on base and edges, with black hair on whole dorsum. Second and third abdominal segments broadly dull brownish yellow on anterior corners, in a triangular form on second but little separated from hind margin, in a subquadrangular form on third confined to anterior half. Fourth segment with a smaller less distinct triangle of same colour on anterior corners. Pubescence of abdomen somewhat longer and thicker, that of the light parts being yellow.

32. *Volucella opalina*, sp. n.

Three female and five male specimens, San Rafael. The males, one each, July 6, 7, and 9, and two, July 10. The females, two July 9 and one July 17. All on flowers of the *Cordia* sp.

Length nearly 10 to 11½ millim.

Differs from *V. cordiæ* as follows:—Face and cheeks entirely without stripes. Front shining brighter greenish, with silvery pollen on each side, extending in narrow border along orbital margin to vertex. Frontal triangle of male as in *nautlana*. Antennæ in both sexes considerably smaller, the third joint not so much narrowed apically. Pubescence of thorax of male as described for *nautlana*, with the black pubescence more conspicuous than the shorter yellowish or whitish; in the female the yellow pubescence is, if anything, more conspicuous than the black, being exactly the same as in male of *nautlana*. In two of the females the short pubescence is whitish and the longer black is much less conspicuous, but is seen to be present; these same females differ further from the other in hair of front being whitish, and they may be considered to constitute a variety. Scutellum as in *nautlana*, both as to colour and pubescence, but even more nearly concolorous with thorax, with greenish, cupreous, and violet reflections. Abdomen wholly without yellowish; with brilliant green, violet, and purple reflections, especially on third and fourth segments. Underside of second and third segments with mostly black hair in male, the white hair being confined to basal edge, but the white more extensive in female. Wings often with the yellow invading and tinging the brown, and with some of the cells hyaline in the centre.

Var. *splendens*, var. n.

I propose this name to distinguish the two females (both July 9) above mentioned as having the hair of front white.

This character must be taken as indicating varietal rank, since the hair of front in the other female is wholly black like that of the males.

33. *Volucella viridana*, sp. n.

One male, San Rafael, July 7. On flowers of the *Cordia* sp. Length 9½ millim.

Front, face, thorax, scutellum, pleuræ, and base of abdomen brilliant shining green, with slight cupreous reflections on the thorax. Antennæ brownish yellow, reaching about two thirds way to summit of tubercle, third joint scarcely wider at base. Face strongly concave above tubercle, and strongly produced downward below. Cheeks with a black stripe, behind which is a triangular yellowish area. No facial stripe, thin pubescence of face whitish. Frontal triangle with whitish hairs, mixed with dark ones behind. Thorax without prescutellar row of bristles, with the golden vestiture and longer blackish hairs as described for *nautlana*, but the black hairs not so conspicuous behind. Scutellum clothed with yellow hairs, with ten weak bristles on border, the apical pair more approximated than in the preceding four species. Abdomen shining cupreous violaceous brown, blended in with the bright green on second segment, so that latter appears mostly bright green from before and wholly brownish cupreous from above. Pubescence of abdomen white on first segment and anterior portions of second, yellow on rest of second and all of third, and black on fourth. Bright green of pectus extending over first and second segments of venter. Legs black; femora shining dark green on underside; tarsi brownish. Wings with whole anterior or outer half fuscous yellow, inner half more nearly hyaline.

This species belongs to the *obesa* group by its coloration and absence of prescutellar bristles, but approaches in form the *amethystina* group.

Phasiidæ.

34. *Hyalomyia ecitonis*, sp. n.

Nine males and seven females. Paso de Telaya, March 29. All taken hovering over the front ranks of a moving army of *Eciton Foreli*, in company with the *Stylogasters* as described in Section I. of this paper (p. 23).

Length of males 6 to 7 millim., of females 5 to 6 millim.

♂. Front equilateral, not trigonal. Frontal bristles rather

strong and thick, decussate; vibrissæ moderately strong and decussate. Wings very broad at base, 3 millim. broad in the larger specimens by about 5 millim. long, rather strongly but irregularly yellowish fuscous on costal half, whitish on inner portion, rather blunt and rounded at tip. The costal fuscous area contains three whitish or hyaline streaks, the darkest fuscous being in vicinity of stigma and containing but one streak of hyaline. The other two streaks are in second costal cell and tip of submarginal. Third vein bowed inward on apical portion, so that the long petiole of apical cell forms a right angle with apical cross vein. Hind cross vein distinctly but not strongly sinuate, distinctly nearer to bend of fourth vein than to small cross vein, the bend of fourth being sharply or abruptly rounded, with the two sections running from the bend at right angles and of equal length. The petiole of apical cell ends well behind the actual centre of wing's tip, owing to its bending posteriorly out of a straight line on apical portion. The hind cross vein is oblique, and with its peculiar curvature, aided by the curvature of fourth and fifth veins, gives the discal cell a shape very similar to that of a gunstock.

Front about as wide as eyes anteriorly, hardly or but slightly narrower posteriorly, with a wide velvet-black vitta slightly wider behind. Orbital margins of front and whole of face silvery white, the orbits with a slight golden shade, especially on front. Antennæ blackish, reaching but little more than halfway to oral margin; third joint hardly twice as long as first. Palpi brownish, slender, clubbed at the end. Occiput and pleuræ brassy-silvery pollinose. Thorax shining black, so marked with pollinose as to show on præscutum five silvery and four rust-black or deep black vittæ, the three silvery and two black median ones being the most clearly defined, and the lateral silvery ones terminating in the humeri. The silvery vittæ are sometimes golden-tinged. These vittæ are more or less distinctly continued on mesoscutum behind suture, the scutellum showing some silvery pollen apically when not discoloured. Abdomen blackish or brownish, elongate-oval, flattened, the whole with more or less of a metallic purplish tinge, with more or less of a thin coating of very fine pale brassy or ashy pollen, with first two segments more or less pale subtranslucent brownish yellowish, except a median vitta which is continued indistinctly on other segments. The yellowish colour is often faint, sometimes obsolete; when present it leaves normally a narrow posterior margin of brown on second segment. Legs black or brownish black, the knees, tibiæ, and tarsi sometimes varying to lighter

brownish or pale. Claws and pulvilli elongate. Tegulæ large, translucent smoky-yellowish, halteres yellow.

♀. Differs in front being about one fourth width of head, frontal stripe and orbital margins in consequence narrower, the silvery of orbits with less of a golden sheen; wings not so broadened or large, evenly fuscous hyaline, without patch of dark fuscous on costa. Abdomen without purplish reflection, shining black or with slight greenish reflection, the brassy-ashy pollen much more conspicuous, forming more or less distinctly a pair of triangular spots on anterior part of second, third, and fourth segments, leaving the median vitta apparent. The pollen varies in its intensity and shade of brassy. It is, together with the thoracic vittæ, sometimes obscure and indistinct in both sexes. Foot-claws and pulvilli moderately short, about as long as last tarsal joint.

Although these two forms (male and female) are in general facies so different, the fact that they were all taken together over the ants, without a single specimen of any other *Hyalomyia* being present, one series being all males while the other is all females, convinces me that they are the two sexes of one species.

It seems probable, from the circumstances under which this *Hyalomyia* was found, that it also, as well as the *Stylogasters*, is parasitic on ants (genus *Eciton*). In all my collecting in this locality, I met with no other specimens of *Hyalomyia* than the above, excepting only the single specimen next described.

35. *Hyalomyia violascens*, sp. n.

One male, San Rafael, June 26.

Length 4½ millim.

Belongs in the group with *punctigera*, Towns., *purpurascens*, Towns., &c., in which the front is trigonal, the eyes of male moderately or closely approximated, and those of female nearly or quite contiguous. Differs from my description of *purpurascens*, ♂ (Pr. Ent. Soc. Wash. ii. p. 137), as follows:—Orbits silvery pollinose, face subsilvery; eyes closely approximated in front of ocelli, nearly obliterating the narrow brownish frontal vitta, which is thus elongate-triangular in front and narrowed to a line behind. Frontal bristles weak. Antennæ black, third joint oval, a little longer and wider than first, silvery in some lights. Palpi very small, filiform, brownish. Thorax silvery only on humeri and pleuræ. The apical pair of scutellar bristles decussate. Abdomen wholly very polished deep violet-black, reticulations of the ashy pollen showing faintly in

scattered places behind. Tegulæ large, pure white; the wings whitish hyaline, well tinged with tawny fuscous on basal half or third.

This may prove to be conspecific with *purpurascens*, but it will at least form a good variety of that species.

Neither of the above species belongs to any of Wulp's Mexican *Hyalomyias*.

[To be continued.]

V.—*The Species and Subspecies of Zebras.* By R. I. Pocock, of the British Museum of Natural History.

Part I.—*Introductory Remarks.*

For some years past, during periodical visits to the museum at Bristol, my attention has been attracted by a stuffed specimen of a zebra-like animal, which, in addition to being labelled "Quagga," possessed special interest, inasmuch as it differed strikingly in the character of its markings from all the zebras in the collection of the British Museum and from all that I had seen in menageries and elsewhere. The true Quagga, as is now admitted on all hands, is extinct, and only a few specimens have been preserved in the various museums of Europe. Consequently the example in question, if correctly named, would be of great zoological interest and of very considerable value as a museum possession. I therefore undertook, with the consent of Mr. Edward Wilson, F.G.S., the curator, who kindly gave me every facility in the way of examining and sketching the specimen, to identify it, if possible, and ascertain as nearly as might be its affinities with regard to the known forms of zebras. As is explained later on, the specimen, though of considerable interest, proved to have no proper claim to the title of quagga. But the task of identification entailed the looking up of a deal of the literature published on the subject by both naturalists and sportsmen and an examination of all the skins and living specimens to which access could be obtained; and since during the investigation a few structural points came to light which have apparently escaped notice until now, and since, with the exception of Dr. Paul Matschie's paper alluded to below, no paper dealing comprehensively with all the species has been published of late years, I have ventured to hope that the notes and observations contained in the following pages, though

necessarily sketchy and far from exhausting even the systematic aspect of the question, may prove of some use to those who are interested in becoming acquainted with the different species and subspecies that have been established.

It must be understood, however, that the statements that have been made have been derived, owing to the scarcity of material, from the examination of a relatively small number of skins, and that extended observations may prove hereafter that some of the conclusions are unjustifiable. For example, in the appended synopsis of species it is asserted that the presence of a longitudinal ventral stripe is distinctive of the zebras as compared with the asses, the assertion resting on its presence in all the zebras and its absence in the asses of the species *hemionus*, *tæniopus*, and *somaliensis* * that I have been able to see. Personally I venture to doubt whether it is ever absent in the zebras, though it must not be forgotten that Gray described the belly of Burchell's zebra as being without stripes, that Sir William Flower states that in the common zebra the belly often has a longitudinal stripe ('The Horse,' p. 86), and that, according to Noack (Zool. Garten, xxxiv. p. 293), the belly of the quagga frequently has a middle band, the qualifying adverb of time in each sentence clearly suggesting the occasional absence of the stripe in the species mentioned.

Concerning the specific characters of the mountain zebra and Grévy's zebra nothing by way of introduction need here be said; but touching Burchell's zebra and its subdivisions a few words of explanation may not be out of place.

There seems to be a widespread misconception on the part of sportsmen in South Africa as to the identity of the genuine Burchell's zebra, for, with the exception of the two well-marked species mentioned above, the name "Burchell's" is applied indiscriminately to all the zebras that range over East and South Africa from Masailand to the Orange and Vaal Rivers. For example, Dr. Donaldson Smith ('Through Unknown African Countries,' p. 255, 1897) speaks of the occurrence of Burchell's zebra near Lake Stephanie; yet it is tolerably certain that no zebra resembling the typical Burchell's occurs to the north of the Zambesi, and even to the south of this river the name is loosely assigned to animals distinguishable at a glance from the principal form. Why the characters of the principal form should have been so completely forgotten is hard to understand, unless, indeed, it be partly due to the circumstance that for many years past a

* Noack, Zool. Garten, April 1884, p. 101 (=*somalicus*, Sclater, P. Z. S. Nov. 1884, p. 540).

zebra from Zululand has been exhibited in the British Museum, and labelled, though quite erroneously, "Burchell's zebra, typical variety." As a matter of fact, a glance at the original figure will show that the specimen in question is very different from the type as figured and described by Gray; or, perhaps—and this seems the more likely explanation—the wide application that is given to the name is attributable to the existence of intermediate forms, which renders an accurate recognition of the different kinds of Burchell's zebra a task of no little difficulty. That a great number of these "kinds" exist is beyond dispute. Moreover, just as the right and left sides of a zebra are seldom, if, indeed, ever, marked in the same way, so, too, are no two members of a herd exactly alike. And yet at the same time an examination of skins from different parts of the vast area, with its varied climate and geographical features, over which the so-called Burchell's zebra roams, forces home the conviction on the mind of the observer that the extreme variations in coloration that occur are not, so to speak, fortuitous sports, but that they are distinctly correlated with geographical distribution. For example, the available evidence shows that the weakly striped type of zebra from Zululand, as exemplified by the specimen in the British Museum, does not occur in Mashunaland *, where a strongly striped type prevails; nor does the Mashunaland zebra seem to be met with in Zululand. The types, in fact, are perfectly distinct when considered apart from other forms. It is true, however, that the animal which always passes in this country as Chapman's zebra presents characters nearly, if not quite, intermediate in their nature between those distinctive of the local races mentioned above, and that Wahlberg's zebra from Zululand similarly constitutes a kind of link between Chapman's and the typical Burchell's. In other words, these forms are not recognizable as distinct species, as Dr. Paul Matschie holds, but must rather take the rank of *subspecies*, the use of this word implying on the part of the describer a belief, firstly, that the forms named are geographical races or incipient species, and, secondly, that intermediate types exist.

The actual naming of such subspecies is, of course, open to the objection that it is not possible to assign a definite name to an absolutely annectant form. But against the opposite course—the course that is usually adopted because it entails no serious trouble—namely, that of neglecting subspecific

* Mr. J. Hollliott Darling informs me that the zebra characteristic of Mashunaland is the form here named *Selousii*, and that he has never met with *Wahlbergi* in the country.

groups and stating in a general kind of way that Burchell's zebra is an exceedingly variable species, the far more important objection may be alleged that it leads to an ignoring of the variations as of no significance and to a total disregard of the highly important but as yet unintelligible fact that in a particular locality a particular form prevails. It is the interpretation of this fact, the recollection of which is greatly assisted by the judicious use of nomenclature, that with the cooperation of the sportsman or collector should be the ultimate object of the systematist.

In the present paper seven such subspecies or local races of Burchell's zebra have been recognized, two of them being forms that have not previously been named. It must be understood, however, that scarcity of properly localized material renders some of the conclusions with regard to these forms more or less tentative, and that skins of zebras of different ages from all localities, wherewith to test the constancy of markings, are indispensable for the satisfactory settlement of the questions; and now that the need for practical evidence of this nature is known, it is hoped that sportsmen will endeavour to obtain it before the advance of civilization has either exterminated these beautiful animals or placed them under the artificial conditions of preservation—a contingency that is certain to follow if we may judge from the fate that has befallen two formerly abundant South-African species, namely the quagga and the so-called common or mountain zebra.

Part II.—*Descriptions of the Species.*

(1) *Equus zebra*, Linn.

Equus zebra, Linnæus, Syst. Nat. ed. x. p. 74 (1758).
Equus montanus, Burchell, Travels &c. i. p. 139 (1822).

This species was originally based upon figures and descriptions apparently representing three distinct species. Two of these are from Edwards's 'Gleanings of Natural History,' v. pls. ccxxii. and ccxxiii., the first of which is the form which now bears the name, the second being the quagga, while the others, though very inaccurate, appear to have been taken from examples of one of the subspecies of *Burchelli* (see Aldrovandi, Quadrup. i. p. 417, pl. viii., and Johnston, Quadrup. pl. v. fig. 1). The specific name *zebra*, however, has been definitely assigned to the species depicted on pl. ccxxii. of Edwards's work, the said figure being drawn from an example (the type) then preserved in the museum of the College of Physicians, London.

Most of the distinctive characters of this species are well known.

The head, neck, body, and legs are closely covered with broad black stripes, which are considerably broader than the pale interspaces. Except for the longitudinal ventral band, the belly is white, the flank-stripes stopping short of the belly as in the quagga, Burchell's zebra, and Grévy's zebra. The spinal stripe is scarcely noticeable on the back, but broadens on the rump and is continued on to the tail, which has a black tip but is without distinct lateral markings. The legs are strongly striped to the hoof, the lower part of the pastern being quite black, and on the inner side are ornamented from above the knees and hocks. On the rump the space between the spinal stripe and the stripe that runs to the root of the tail is entirely covered with transverse bars, forming a continuous series with the upper ends of the flank-stripes, and becoming shorter and shorter towards the root of the tail. This constitutes the so-called "gridiron pattern" characteristic of this species. A similar pattern, however, though on a smaller scale, is not unfrequently noticeable in subspecies of *E. Burchelli*; but in the latter the aforesaid transverse bars do not reach the stripe that runs to the base of the tail, but the uppermost of the rump-stripes that passes backwards from the flanks and lies adjacent to the spinal stripe. The quarters are banded with arched longitudinal stripes, but only the lower or front ends of the two uppermost of these extend on to the belly. On the face in front of the eyes and on the forehead the stripes are tan-coloured and pass into the large nostril-patches of the same tint, the muzzle itself being black.

The ears are long and asinine, the feet narrow and fitted for rocky country; and, lastly, there is one curious structural feature in which this species differs not only from the other zebras but from all the species of Equidæ—this is the reversal in direction of the hair along the spine between the rump and withers.

Though formerly abundant in the mountainous districts of Cape Colony, this species is now verging on extinction. Happily, however, the artificial preservation of herds has postponed, at all events for a time, this inevitable result of the encroachment of civilization.

(2) *Equus quagga*, Gmelin.

Equus quagga, Gmelin's edition of Linné's Syst. Nat. i., Mammalia, p. 213 (1788).

? *Equus isabellinus*, H. Smith, Naturalist's Library, Horses, p. 332 pl. xxv. (1841).

For the type of this species may be selected the specimen, belonging to the then Prince of Wales, which was figured and described as the female of the mountain zebra by Edwards in his 'Gleanings of Natural History,' v. pl. ccxxiii. The other references cited by Gmelin are to a description given by Pennant in his 'History,' p. 14. no. 3, to the mention of the species by Masson (Phil. Trans. (Acta Angl.) lxvi. p. 297), and to a figure published by Buffon (Hist. Nat. xii. p. 1, pl. ii.) which unmistakably represents an example of *E. zebra*, Linn.

Edwards's figure and description make perfectly clear the essential characters of the type of this now extinct species. The ground-colour of the body and head were a pale chestnut, the belly, legs, and tail, including the tuft, being white. The muzzle was darker than the face, being of a brownish hue, but not so black as in Burchell's zebra; the head, neck, and fore part of the body, however, were strongly marked with black stripes, apparently exactly as in that species. Moreover, on the hinder part of the flanks and upper part of the quarters the stripes dorsally take a backward bend assuming an obliquely longitudinal direction, but, instead of being continuous, they were broken up into a series of blotches or large spots; and a row of similar spots was observable on each side of the spinal stripe between the withers and rump, these spots representing the upper ends of the flank-stripes. The spinal stripe was continued on to the tail, and there was a median ventral stripe, the rest of the belly, like the whole of the lower part of the quarters and legs, being free from stripes.

The specimen figured and described by H. Smith as *E. isabellinus* is said by Gray to be the young of *E. quagga*. Unfortunately the type, once in the British Museum, appears to be no longer in existence. It differed from all known zebras, and resembled the asses, in having the muzzle white and the mane unstriped.

The example identified as the quagga contained in the collection of the British Museum differs strikingly from the specimen figured by Edwards in the indistinctness and indefiniteness of the stripes not only on the body, but also on the head and neck. Instead of the well-defined black stripes noticeable in the original figure, all the stripes are reddish brown, and on the head are only distinct on the area that lies between the eyes and ears, on the cheek, and on the nose to a point halfway between the eye and the nostril. The neck is marked with irregular broad brown double stripes separated by narrow yellowish-white interspaces; the withers are

striped, but the shoulder is practically unstriped. Along the sides of the spinal stripe dark brown patches representing the dorsal extremities of the flank-stripes are traceable as far as the rump; but the posterior part of the flanks is very indistinctly banded, presenting a mottled appearance. It is evident, however, that towards the quarters the stripes were arranged in an obliquely longitudinal direction. It may be added that the specimen under notice is certainly faded; but, taking these facts into consideration, there is no doubt that it was originally very different from the example seen by Edwards.

The figure of this species published by Gray in the 'Knowsley Menagerie,' from which those given by Noack (Zool. Garten, xxxiv. p. 290) have been adapted, show the backward extension of the stripes as far as the quarters and their breaking up into spots, as in the type; whereas in the coloured drawing of the species in Harris's 'Game Animals of South Africa,' as well as in Hamilton Smith's volume on the horse, the dark stripes, though black and well defined over the head and neck, scarcely extend past the withers. According to Matschie, too (Zool. Garten, xxxv. p. 38), the ground-colour, possibly from exposure to light, varies from dark brown to a much paler tint.

It is sometimes stated that the tail of the quagga is more thickly hairy than in the other zebras, and approaches that of domestic horses. No evidence of this fact, however, is supplied by Edwards's figure nor by the specimen in the British Museum, nor by the specimen of which there is a photogravure in Sir William Flower's book on the horse (see p. 90). It is noticeable, however, that in the Museum example the hair on the fetlocks is longer than in any zebra that I have seen.

This species was formerly abundant on the flats of Cape Colony to the south of the Orange River.

(3) *Equus Burchelli* (Gray).

Asinus Burchellii, J. E. Gray, Zool. Journ. i. p. 247, pl. iv. (1825).
Equus zebroides, Lesson, Manuel de Mammalogie, p. 346 (1827).
Equus festivus, Wagner, in Schreber's Säugethiere, vi. p. 216, pl. cccxvii. B. (1834).
Hippotigris campestris, H. Smith, Jardine's Naturalist's Library, Horses, p. 329 (1841).

The above synonymy needs no justification, seeing that the three names *zebroides*, *festivus*, and *campestris* were proposed by their authors to replace the older name *Burchelli*, apparently for no better reason than the imaginary inappropriateness of the latter title.

This species was apparently first met with, by the traveller whose name it bears, across the Vaal River in British Bechuanaland. The exact locality of the type specimen seems to have been unrecorded, Gray contenting himself with the statement that the species occurs on the flats near the Cape. Burchell, however, tells us that he fell in with this species at several localities—to wit, Klaarwater, Kuruman, Littaku, &c. Matschie, indeed (Zool. Garten, xxxv. p. 66, 1894), believes that it extends eastwards as far as Zululand, basing his opinion apparently upon the assertion by Buckley that Burchell's zebra is common in that country. It seems evident, however, that Buckley was speaking, not of the typical *Burchelli*, nor of the form recognized by Matschie as *Burchelli*, in which there are no stripes on the legs, fore or hind, and only the merest traces of them on the flanks, but of either the form termed *Chapmanni* or that named *Wahlbergi*, in which, as explained below, the stripes reach below the hocks or even to the hoofs.

According to Gray, the body of the type was white and marked with alternate broad stripes of black and narrow ones of brown, the latter nearly filling up the intervals between the former. Moreover, the "shadow-stripes," as stated in the description and clearly shown in the figure, were visible not only on the shoulder but right up the neck almost as far as the head. In other words, it may be briefly said that every broad black stripe on the neck and body was accompanied by its corresponding shadow-stripe; and, lastly, none of the body-stripes pass beneath the belly, and only the upper part of the flank is ornamented with them, the lower part of this region, the belly, legs, and tail being quite white, and, according to Gray, without stripes, though probably this assertion must not be considered to include the median belly-stripe and the spinal stripe, which in all other known zebras spreads on to the root of the tail.

The form figured and described by Matschie (Zool. Garten, xxxv. p. 66, 1894) as Burchell's zebra, though showing the same distribution of stripes as in Gray's type, appears to differ from it in the entire absence of shadow-stripes. None, at least, are mentioned in the description and none appear on the figure taken from a living specimen, from an unstated locality, in the Zoological Gardens at Berlin.

But though differing from the type, this specimen seems to resemble the left-hand figure of the plate depicting Burchell's zebras published by Gray in the 'Knowsley Menagerie,' the drawing on the right representing an animal closely approaching the typical form, and distinguishable from

the other by its paler colour and the presence of shadow-stripes *.

It is the specimen represented in the left-hand figure that the two examples that I have seen mostly resemble. One of these is in the Rothschild Museum at Tring and the other in the City Museum at Bristol. These examples, however, are not exactly alike, and for neither, unfortunately, is there, I believe, any exact locality known.

In the Bristol specimen the head and neck are whitish and normally marked with brownish-black stripes. The upper part of the body and the quarters, on the contrary, are clothed with dark ruddy greyish-brown hair, the dark stripes

* Mr. J. ffolliott Darling tells me that there is a specimen of this subspecies in the Dublin Museum. It has the shadow-stripes extending halfway along the neck as in the type; but there are faint bars upon the hocks and *two* of the flank-stripes pass beneath the belly to join the ventral stripe.

being less distinctly defined than on the neck and more or less losing themselves in the brownish colour of the intervening spaces. The lower half of the quarters and of the shoulder, as well as the belly, are whitish, the pale tint of the latter region being rather sharply defined from the dusky tint of the flanks. The belly-stripe is distinct, but the legs are without stripes, though the knees and shins of the fore legs and the pasterns and fetlocks of fore and hind legs are distinctly brownish. There are no shadow-stripes in any way comparable in extent and distinctness to those which were visible in the specimen described by Gray, there being none visible upon the neck and those on the flanks and quarters being merely represented by indistinct patches or blotches. And, lastly, it may be mentioned that the spinal stripe is separated from the upper ends of the flank-stripes, but is touched on each side on the rump by a short branch from the adjacent stripe. The nostril-patches are black.

The example in the Tring Museum, so far as could be judged from a cursory examination, differs from the one just described in two respects—namely, the upward extension of the flank-stripes to touch the spinal stripe and the presence of bars upon the knees and hocks.

On account of the prevalent misconception as to the characters of the true Burchell's zebra, a sketch taken from the specimen in the Bristol Museum has been published on p. 41 of this paper.

There is no specimen of this zebra in the British Museum, and it appears to be scarce in the menageries and museums of this country; and on account of the general application of the term *Burchelli* to any or all of its subspecies, we are in ignorance of the exact area that it now occupies in S. Africa.

Subspecies *antiquorum* (H. Smith).

Hippotigris antiquorum, H. Smith, in Jardine's Naturalist's Library, Horses, p. 327, pl. xxii. (1841).

Equus antiquorum, Matschie, Zool. Garten, xxxv. p. 68, fig. (1894).

According to the figures published by Hamilton Smith and Matschie, and to the description given by the latter author, the zebra that received the name *antiquorum*, on the supposition that it was specifically identical with the one seen in the early days of African travel in the Congo region by Pigafetta, differs from Burchell's zebra in having the stripes extending over the quarters almost down to the hock and from the shoulder to the knee, while those on the flanks, instead of stopping short where the white of the belly begins,

pass on to the lower surface of the belly, though without coming into contact with the ventral stripe. Shadow-stripes are visible over the quarters and flanks almost up to the withers, the tail is laterally banded, and the nostril-patches are reddish brown.

Hamilton Smith calls this form the Congo Dauw, though there is no evidence that the example he figured and described came from that region. Matschie, on the other hand, speaks of it as the Damaraland zebra on the evidence afforded by a specimen in the Berlin Museum from the southern border of the Kalahari desert and from a reference to a zebra with white legs said by Chapman to inhabit Damaraland.

I have had no opportunity of examining a specimen of this subspecies.

Subspecies *Chapmanni*, Layard.

Equus Chapmanni, Layard, Proc. Zool. Soc. 1865, p. 417.

When Layard established this species he was apparently alike unsuspicious of its near relationship to *E. Burchelli* and unaware of the existence of *E. antiquorum*, since the emphatic terms in which he speaks of its distinctness apply to it only as compared with the mountain zebra (*E. zebra*). From this point of view *E. Chapmanni* is, of course, a well-marked form, but from *antiquorum* it seems to differ only in characters of subspecific importance. There is, however, unfortunately no type specimen and no figure, so far as I am aware, of any of the original examples from which the description was drawn up. But provisionally, at all events, the name may be attached to the form figured by Dr. Sclater as *Chapmanni* (P. Z. S. 1865, pl. xxii.), a drawing of apparently the same subspecies being published in Sir William Flower's book on the Horse, p. 87. From the account given by Layard it may be gathered that *Chapmanni* may be recognized from *antiquorum* at all events in the union of the lower ends of the body-stripes with the ventral stripe. The legs, too, are marked, though sometimes only faintly, to the hoof. Baines, indeed (*l. c.* p. 419), comparing *Chapmanni* with what he calls Burchell's zebra, though probably not referring to the typical *Burchelli*, mentions the extension of the leg-stripes to the hoof in Chapman's zebra as compared with the stopping short of these marks at the hocks and knees in Burchell's species as the chief distinguishing feature between the two. Nevertheless it is questionable what value is to be attached to this character in comparing *Chapmanni* with *antiquorum*, since H. Smith, in his diagnosis of the latter, states that the

legs are at times marked to the fetlocks. It is clear, however, that the author may have confounded the two subspecies. One other feature mentioned by Chapman may be noticed—namely, that on the thighs the stripes are alternately pale brown and dark brown (*l. c.* p. 418).

I have seen no zebra skin that exactly fits this description, but at the present time there are several specimens living in the Zoological Gardens in London that precisely coincide with it. The legs are marked to the hoof, though not strongly striped thereto; shadow-stripes are visible on the quarters, and the muzzle-patches are almost black.

Lastly, these zebras seem to be identical in all particulars with the one living in the Zoological Gardens in Berlin which Matschie has figured (Zool. Garten, xxxv. p. 70, 1894) to illustrate the distinctive features of the species he has named *Böhmi*. See also fig. 52, p. 95, 'Die Säugethiere Ost-Afrikas,' Berlin, 1895.

Chapman fell in with the zebra which bears his name in the country lying between Damaraland and Matabeleland, the animal, according to Layard, being first met with 200 miles inland of Walvisch Bay, that is to say, in Damaraland, where it doubtless encroaches upon the territory of *E. antiquorum* and probably blends with it.

Subspecies *Wahlbergi*, nov.

This subspecies is based upon a stuffed specimen obtained in Zululand by Wahlberg, and now exhibited in the Mammalian Gallery of the Natural History Museum (B.M. no. 46.6.2.76).

The stripes are a deep chocolate-brown in colour; those on the flanks are wider than the intervening spaces, but on the quarters the principal stripes are narrow, being only a little wider than the shadow-stripes, which are very distinct on this region and are traceable up to the withers. It is also noticeable that the first principal stripe below the one that runs to the root of the tail is almost as pale as the shadow-stripes. On the lower half of the quarters and shoulder the stripes begin to die away, becoming gradually thinner and more widely spaced, but are stronger on the knees and hocks than immediately above and below these joints. They extend to a point about halfway between the hocks or knees and fetlocks, the fetlocks, pasterns, and inner side of the legs being without markings. The lower ends of the flank-stripes meet the ventral stripe. The tail is laterally spotted, its tuft being almost entirely white, with only a few black hairs at

the tip. The nostril-patches dull tan-coloured (possibly faded).

In the character of its markings this zebra resembles in a general way the West-African *E. antiquorum*, but appears to differ at least in the fusion of the flank-stripes with the ventral stripe. Moreover, judging by the figure that Matschie has published, the body-stripes in *antiquorum* are narrower than the intervening spaces, not broader as in *Wahlbergi*, and the principal stripes across the quarters are much broader and stronger as compared with the shadow-stripes than in the Zululand form.

Unfortunately too little is known about *Chapmanni* to make a close comparison between it and *Wahlbergi* possible. It is stated, however, that the legs were marked to the hoof, and there is every reason for concluding that in a fairly strongly striped form, such as *Chapmanni* seems to be, the stripes upon the quarters exhibit no such indications of dying away as are observable in *Wahlbergi*.

In the Rothschild Museum at Tring there is also an example of this subspecies from Zululand. It differs from the type in the breaking up of the stripes on the lower half of the quarters and shoulder into an irregularly reticulated pattern.

Subspecies *Selousii*, nov.

This subspecies is based upon a specimen shot by Mr. F. C. Selous on the Manyami River in Mashunaland, and now exhibited in the Mammalian Gallery of the Natural History Museum (B.M. no. 83.7.28.9).

The body and neck are covered with broad brownish-black stripes, which are considerably wider than the intervening yellowish-white spaces, and the principal stripes on the quarters form broad black bands more than half the width of the pale spaces. These spaces are marked by narrow and faint shadow-stripes, much thinner than the principal stripes; faint traces of similar shadow-stripes are just discernible on the flanks. The tail is strongly banded, the stripes meeting the caudal continuation of the spinal stripe; the tuft is black, with only a few long white hairs at its base. On the legs the stripes show no signs of diminution either in thickness or intensity, being black and nearly as broad as the intervening white bands, while over the fetlocks and pasterns they become more or less fused together, the lower part of the pastern being quite black. The inner side of the pasterns and fetlocks of all the limbs are as strongly striped as the outer side; the knees and hocks are also banded on the inner side, and on the

hind leg there are stripes on the inner side of the cannon-bone; but for the rest the inner surfaces of the legs are unstriped, though the ends of the stripes of the outer side extend round the front and back of the limbs. The nostril-patches are coffee-brown.

This form seems to be an exaggeration of the type known as *Chapmanni*, but appears to be separable from it by strength of the leg-markings and the much blacker fetlocks and pasterns. From *Wahlbergi* it is strikingly different, not only in the striping of the legs but also in that of the body and quarters, the principal stripes being noticeably wider as compared with the pale interspaces and the shadow-stripes very much fainter.

A second specimen of this subspecies that I have seen was also obtained in Mashunaland by Mr. Selous, and forms part of the collection of the Hon. Walter Rothschild at Tring. It substantially agrees with the type, but has the shadow-stripes more conspicuous on the flanks.

Subspecies *Crawshayi*, de Winton.

Equus Burchelli Crawshaii, de Winton, Ann. & Mag. Nat. Hist. (6) xvii. p. 319 (1896).

Of this subspecies, which inhabits the highlands of British Central Africa to the west and south of Lake Nyasa, the British Museum possesses three skins—one (the type) from Henga (*Crawshay*), a second from British Central Africa (*A. Sharpe*), and the third (a foal) from Mount Zomba, also obtained by the last-named collector.

In general appearance *Crawshayi* most nearly approaches the Mashunaland form *Selousii*, but is quite distinct from the latter, as from all the other subspecies of *Burchelli*, as Crawshay (Proc. Zool. Soc. 1895, p. 689) originally supposed. In the first place, there is no trace of shadow-stripes even on the quarters, where the stripes, black, as in other parts of the body, are as broad or even broader than the intervening spaces. The tail is not decidedly striped laterally, but strongly spotted, with the tuft black. The legs are, if anything, even more strongly striped than in *Selousii*, the pasterns being black above the hoof and the inner surface barred from the knees and hocks downwards. And, lastly, the nostril-patches are bright tan in colour. It may be added, moreover, that there is a strong tendency in this form for the upper quarter stripes to break up into a network of bars which presents a superficial resemblance to the so-called gridiron pattern of the mountain zebra. Similar variations, however, are not infrequent in zebras of the *Chapmanni* type.

The foal from Zomba, mentioned above, is interesting, inasmuch as it differs from the typical form in having the nostril-patches black and six complete bands and one short one between the shoulder-stripe and the first flank-stripe that dorsally takes a backward bend on to the summit of the quarters, there being but four of these stripes in the type, four or five being the number in the various forms of *Burchelli*, as already pointed out by Prof. Ewart ('The Veterinarian,' Nov. 1896, p. 11, author's copy).

Subspecies *Grantii*, De Winton.

Equus Burchelli Granti, de Winton, Ann. & Mag. Nat. Hist. (6) xvii. p. 319 (1896).

In the collection of the British Museum there are three more or less imperfect skins of this subspecies, which may be comprehensively spoken of as the Masailand zebra. One of these was shot by Mr. J. Thomson at Uganda (see Proc. Zool. Soc. 1890, p. 413, fig.); the others were obtained by Dr. Gregory, one at Lake Baringo and the other on the Theca Theca River, upper Tana River (type).

It resembles the Nyasaland form *Crawshayi* in the entire absence of shadow-stripes, but may be readily distinguished by the deep chocolate-brown colour of the stripes, which are even wider than in Crawshay's zebra, those on the quarters being very noticeably broader than the intervening spaces, and by the black nostril-patches. The tail, too, is more decidedly striped at the sides, the tuft being black. The skin of the lower half of the legs is unfortunately cut away, but these appendages were probably striped to the hoof.

On geographical grounds it might be supposed that this subspecies would prove identical with *Equus Böhmi*, based upon a skin alleged to have been brought from Kilima Njaro and described by Matschie (SB. Ges. nat. Fr. Berlin, 1892, p. 131) as being distinguished by its whitish-yellow colour, broader stripes, legs banded though not strongly to the hoof, and shadow-stripes visible only on the quarters, the absence of any reddish-brown nostril-patches being subsequently added as a differential character (Zool. Garten, xxxv. p. 70). As has been observed, however (*suprà*, p. 44), there is nothing in this diagnosis that serves to distinguish *Böhmi* from specimens, said to be South-African, now living at the Zoological Gardens in London, and ascribed, not without justification, to *E. Chapmanni*, Layard. At all events the presence of the shadow-stripes stamps *Böhmi* as belonging to the type of Burchell's zebra that is characteristic of the area to the south of the Zambesi, and differentiates it at

once from both of the East-African forms established by Mr. de Winton.

(4) *Equus Grevyi*, Oustalet.

Equus Grevyi, Oustalet, 'La Nature,' x. p. 12, 1882.

This species, the most northerly of the zebras inhabiting Abyssinia and Somaliland, is strikingly different from the rest of the group (see figures in Proc. Zool. Soc. 1882, p. 721, and 1890, p. 413). The flanks and quarters are covered with a great number of narrow deep brown stripes separated by still narrower interspaces. The belly is free from transverse stripes as in the mountain zebra (*E. zebra*); but upon the quarters there are no broad obliquely longitudinal stripes, such as are seen in the last-named species and the various forms of *E. Burchelli*, the bands upon the upper half of this area being vertical (transverse), resembling both in size and direction those of the flanks; on the lower half of the quarters they assume a longitudinal direction, and are continued thence on to the hind legs, which, like the fore pair, are closely striped to the hoof inside and outside. Again, the spinal stripe, narrow behind the withers, is very broad over the saddle and rump, but broader on the saddle, where it fuses with the flank-stripes, than on the rump, where it is separated by a very wide space on each side from the upper ends of the quarter-stripes. The tail is not striped at the sides, but spotted, and its tuft is composed of black and white hairs. Connected with the markings on the head there are two peculiarities:—Firstly, the muzzle is not black, as in the other species (? the quagga), but greyish, and not many shades darker than the pale ground-colour of the rest of the head; and, secondly, the stripes continued from the forehead on to the nose usually fail to meet the muzzle-patches, being at most connected with them by very fine lines. Lastly, the nostril-patches are not black, as stated by Matschie (Zool. Garten, xxxv. p. 71), but tan-coloured.

So far as structural features are concerned, in addition to the greater length of the face and ears as compared with the other zebras, this species is quite peculiar for the minute size of those bare patches of skin above the knee on the fore legs, which in England are spoken of as warts or chestnuts.

The British Museum has skins and heads of this species from Berbera and from Durhi, Ogardain, 3000 feet alt., in Somaliland (*Capt. Swayne*), as well as a mounted specimen shot by Col. Paget in this same country.

The subjoined table gives a summary of the chief characters

and conclusions mentioned in the foregoing pages. The species have been arranged in accordance with my views as to their affinities. In my opinion Grévy's zebra stands apart from all the rest, the common mountain zebra having less affinity with it than with those of the *Burchelli* type, although helping in part to bridge over the interval between the two. There seems, however, to be but little evidence to show to which of the fully-striped subspecies of Burchell's the common zebra is most related, though for choice one would suggest one of those that occur to the north of the Zambesi—perhaps *Crawshayi*—in which there are no shadow-stripes. It is interesting to note in connexion with the subspecies of Burchell's zebra that from north to south there is a gradual lessening of the stripes both in intensity and extension, the gradation from *Crawshayi* to *Selousii* and thence through *Chapmanni* and *Wahlbergi* or *antiquorum* to *Burchelli* being very striking, the culminating point being reached by the quagga, which resembles the true *Burchelli* in many points both of colour and structure.

a. Head, neck, and body, with the exception of the spinal and sometimes the shoulder-stripe, unstriped; no longitudinal belly-stripe; muzzle white, without patches above the nostrils, contrasting sharply with the darker tint of the head ..... Asses. (Central Asia to Somaliland.)

b. Head, neck, and, at all events, the fore part of the body distinctly striped; a longitudinal belly-stripe present; muzzle usually black, at all events not lighter than the ground-colour of the face, with a conspicuous blotch of dark-coloured hair above the nostrils .... Zebras. (Abyssinia and Somaliland to Cape Colony.)

a[1]. Warts on the fore legs very small; stripes on body and quarters narrow; none of those on the flanks bent backwards dorsally to extend on to the quarters, the upper half of which is covered with vertical stripes arranged concentrically and almost semicircularly around the root of the tail; spinal stripe very broad, broadest on the middle of the back; muzzle of a greyish tint; stripes on the nose practically stopping short of the nostril-patches ..... *Grevyi*. (Abyssinia and Somaliland.)

b[1]. Warts on fore legs large; stripes broader; quarters marked with obliquely longitudinal stripes, the upper of which arise from the posterior end of the body, where the upper extremities of the stripes are bent

backwards towards the root of the tail; no concentric arrangement of stripes round the root of the tail; muzzle dark, usually black; the stripes on the nose continuous with the nostril-patches..... (Masailand to Cape Colony.)

a^2. Hairs along the spine between the rump and the withers reversed in direction of growth; ears longer, hoofs narrower, tail-tuft more scanty; all the body-stripes, with the exception of two which pass on to the rump and quarters, running up to meet the spinal stripe and cutting it at right angles; the area which lies over the rump between the spinal stripe and the uppermost haunch-stripe which runs to the root of the tail not longitudinally striped, but covered with the so-called gridiron pattern of transverse bars. *zebra*, Linn. (Mountainous parts of Cape Colony.)

b^2. Hairs on spine not reversed in direction; ears shorter, hoofs broader, tail-tuft fuller; the upper ends of some five or six of the stripes in the posterior half of the body bent backwards in a direction parallel to the spinal stripe; the area between the stripe then runs to the root of the tail, and the spinal stripe on the rump not covered with transverse bars, but crossed longitudinally by the backwardly extending upper extremity of at least one of the body-stripes (not true of quagga in every particular) ..... (Plains and tablelands of East and South Africa.)

a^3. Ground-colour of neck, body, and quarters mostly pale ochre-yellow, sometimes almost white, not chestnut; the stripes, which extend back as far as the rump and quarters, complete, and showing but slight indications of breaking up into spots ..... (Burchell's zebra *sensu latissimo*.)

a^4. Quarters marked with strong complete stripes below the long stripe that runs to the root of the tail; legs striped at least as far as the hocks and knees; body-stripes extending on to the belly and (except in *antiquorum*) touching the belly-stripe; tail spotted or striped laterally

a^5. No trace of shadow-stripes between the principal stripes either on the body or quarters; principal stripes on the quarters broader, or at

least as broad, as the intervening light spaces ..... (E. Africa, north of the Zambesi.)

a^6. Stripes brown, broad; nostril-patches black ..... *Grantii*, de Winton. (Masailand.)

b^6. Stripes blacker, narrower; nostril-patches yellowish brown (tan) ..... *Crawshayi*, de Winton. (Nyasaland.)

b^5. Shadow-stripes traceable between the principal stripes at least on the quarters; principal stripes on the quarters as a rule narrower than the intervening spaces .... (South of the Zambesi.)

a^7. Body-stripes passing beneath the belly and meeting the ventral stripe.

a^8. Shadow-stripes on quarters faint and narrow, much narrower than the principal stripes; legs mottled or striped to hoof.

a^9. Outer side of legs strongly striped to hoof; fetlocks and pasterns completely striped both externally and internally; lower half of pastern black from the fusion of stripes, as in *Crawshayi* ..... *Selousii*, nov. (Mashunaland.)

b^9. Stripes on lower half of legs showing a distinct tendency to become obliterated and break up into irregular brown spots; lower part of pastern not continuously black ..... *Chapmanni*, Layard*. (Between Damaraland and Matabeleland.)

b^8. Shadow-stripes on quarters strong and distinct, not very much narrower than the principal stripes, which are themselves very narrow, far narrower than the intervening spaces that contain the shadow-stripes (fetlocks and pasterns without stripes or spots)..... *Wahlbergi*, nov. (Zululand.)

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* Including also *Böhmi*, Matschie, judging from figures and descriptions.

b^7. Lower ends of body-stripes on belly not meeting ventral stripe; principal stripes on quarters broad; legs not or hardly striped below knees and hocks ..... *antiquorum*, H. Smith. (Damaraland.)

b^4 Quarters with only a few abbreviated stripes below the long stripe that runs to the root of the tail; body-stripes stopping short above the belly as in *E. zebra*, *E. quagga*, and *E. Grevyi*; legs without stripes, except sometimes on the knees and hocks; tail usually without lateral spots or stripes ..... *Burchelli*, Gray (*sensu stricto*). (British Bechuanaland.)

b^3. Ground-colour yellowish red or chestnut, with the exception of the belly and legs, which are pale and without stripes as in *E. Burchelli*; body-stripes showing a strong tendency to die away on the posterior part of the flanks, when reaching the quarters broken up into spots ..... *quagga*, Gmelin. (Cape Colony, south of Orange River.)

VI.—*Aquatic Rhynchota: Descriptions and Notes.*—No. I.

By George W. Kirkaldy.

Fam. Corixidæ.

Diaprepocoris, gen. nov.

Corixinarum genus, scutello magno parapleurisque minutis instructis; ovalis, depressus; capite magno, basi supra thoracem producto. Pronoto transversissimo, non rastrato. Scutello hemielytrisque non rastratis. Rostro unisegmentato. Palis bisegmentatis. Pedibus intermediis posticisque *Corixæ*, Geoff., similibus.

Oval, depressed, dull; *head* large (very convex at the vertex), overlapping the very transverse non-rastrate pronotum. *Scutellum* very large, not rastrate; *parapleura* minute. *Hemielytra* not rastrate.

Rostrum unisegmentate. *Palæ* bisegmentate.

Intermediate and posterior *pedes* as in *Corixa*, Geoff.

This utterly distinct genus is readily distinguished by the very transverse pronotum and by the large scutellum; the parapleura and the unisegmentate rostrum will further sepa-

rate it from *Sigara*, Fabr., and the comparatively short posterior pedes from the long-legged *Nychia*, Stål. It appears to be most closely related to *Corixa*, and perhaps is intermediate between that genus and *Nychia*.

1. *Diaprepocoris barycephala*, sp. n.

Caput subquadratum, basi concava, cum oculis hemisphæroideum, oculorum marginibus lateralibus interioribus fere parallelis, fere perpendicularibus capitis ad basin, verticem versus leviter divergentibus, basi quam oculorum utrorumvis basi latiore (a super. vis.). Pronotum circiter quadruplum latius quam longius, rugulosum. Scutellum isoscele, non acuminatum. Hemielytra pubescente curtissima instructa, membranæ lobis subæqualibus. Tarsi intermedii unguiculis longiores, tarsi tibiæque subæquales. Femora anteriora apicem versus calcare subtruncato instructa.

♂ mihi ignotus.

♀. Palarum segmentum 1^um^ (a latere vis.) angustum, sublunatum; subtus concavum; segmentum 2^um^ angustissimum, convexiusculum, subcylindricum. Capitis frons longitudinaliter mediatim subcarinata.

Head flavous, wider basally (seen from above) than either of the eyes, dorsal surface roughly square, interior lateral margins of the eyes nearly parallel and almost perpendicular to the base of the head, slightly diverging from the base; base of head concave, slightly sinuate. Head with eyes (seen from above) hemisphæroidal; eyes fuscous. *Pronotum* about four times as wide as long, very finely rugose, brownish black anteriorly (pale where covered by the head), flavescent posteriorly, lateral margins widely luteous.

Scutellum flavescent, infuscated, isosceles triangular, very large, lateral margins narrowly black.

Hemielytra sordid yellowish (slightly infuscated near the base of the clavus, on the basal half of the corium, and more or less of the apical half of the membrane), without guttulate or vermiculate markings; scutellum and hemielytra furnished with short black pubescence. Lobes of membrane subequal. Anterior half of *embolium* luteous.

Metanotum black; *dorsal* surface of *abdomen* dark fuscous (varying); connexivum dark fuscous anteriorly, paler posteriorly. *Pedes*, including *unguiculi*, luteo-testaceous; *anterior femora* armed with a blunt spur near the apex; intermediate tibiæ and tarsi subequal, unguiculi shorter; intermediate femora with short golden hairs; posterior tibiæ and tarsi armed with short concolorous spines.

Whole *ventral* surface flavescent testaceous, with very fine short pale yellow pubescence.

The female apparently has no facial impression.

Head very convex, frons with a longitudinal median carina. *Palæ*: first segment sublunate; second segment short, very narrow, slightly convex, subcylindrical.

N.B.—This second segment appears to be a genuine second tarsal segment, not a single claw. The "Klaue" of the palæ of various *Corixæ* mentioned and figured by Fieber (Bull. Soc. Impér. Moscou, xxi. (1e partie) tab. x. fig. 9 &c., 1848) seems to me to be only a rather stiff palal bristle.

Long. 6·2–7·3 millim.; lat. pronot. 2·4–3 millim.; lat. max. hemiel. 3·5 millim.

Launceston (Tasmania) and Melbourne (Victoria): British Museum.

Corixa, Geoff.

2. *Corixa eurynome*, sp. n.

Corixæ atomariæ, Illiger, remote affinis; capite fere rectangulari, oculorum marginibus lateralibus interioribus fere perpendicularibus capitis ad basin; pronoto hemielytrisque non rastratis, punctatissimis; pronoto subacutangulato; tibiis unguiculisque intermediis subæqualibus, tarsis longioribus.

♂. Faciei impressione fere ad verticem attingente; palis anguste cultratis. Strigili minutissima, subquadrata, dentium seriebus latis quattuor instructis.

♀. Faciei impressione labioque ovoidem formantibus; palis anguste cultratis.

Very different from any other described *Corixa*, in appearance not unlike *C. atomaria*, Illiger, superficially.

Shining; *head* almost rectangular, pale testaceous, interior lateral margins of the eyes almost perpendicular to the base of the head.

Pronotal angles rounded, subacute.

Pronotum and *hemielytra* sordid testaceous, more or less infuscated, densely furnished with black punctuations, not rastrate; no pronotal or hemielytral guttulate or vermiculate lineations, although the regular and dense punctuation gives the appearance of narrow black lines; hemielytra paler at the base (owing to absence of punctuation), covered with short pale hairs.

Meso- and *metanotum* black; *mesosternum* medianly black.

Ventral aspect of abdomen and *pedes* (including coxæ) flavo-testaceous; intermediate tibiæ rather longer than unguiculi, which are much longer than the tarsi.

♂. *Facial impression* reaching almost to the vertex; dorsal aspect of head rather longer than in female, not longi-

tudinally medianly carinate; palæ rather stouter than in female. *Eyes* sordid pinkish.

Strigil exceedingly minute, bluish black, subquadrate, with four broad rows of "teeth."

♀. Head very convex, *facial impression* and labium forming an ovoid, the base of which is continued slightly beyond the apical margins of the eyes; the impression is covered with short, dense, pale golden hairs.

Head medianly longitudinally carinate. *Eyes* greenish.

Long. 8·5–9 millim.

Adelaide River, South Australia: British Museum.

I am indebted to Mr. W. F. Kirby, F.L.S., for permission to describe the two preceding species.

3. *Corixa australis*, Fieber.

Corixa australis, Fieber, Abh. k. böhm. Ges. Wiss. (5) vii. p. 232, pl. i. fig. 15 (1851).

Head punctate. Width of base less than that of either eye (as seen from above).

Pronotum obtuse-angled, very rastrate.

Pedes: intermediate tibiæ rather longer than the unguiculi, which are much longer than the tarsi.

♂. *Strigil* comparatively large, suboval, truncated at both ends, bluish black, furnished with five or six rows of "teeth," the fourth or fifth being broken up into two or three dextrolaterally.

Facial impression obovate, very large and deep, extending almost to the vertex; base of the interior impression curved, its lowest point in a line with the apical margins of the eyes.

The female has not yet been described.

I have not seen the type of this species, but two males from Tasmania in the British Museum accord with Fieber's description and his figure of the male palæ.

I am acquainted with only three Australian *Corixæ*, all very different:—*C. australis*, Fieber, apparently belonging to the "*limitata*, Fieber," group; *C. eurynome*, described above; and a species allied to *striata*, Linn., of which I have seen a single specimen. Two species are also recorded from New Zealand:—*C. arguta*, Buch. White (Ent. Month. Mag. xv. p. 161, 1878), and *C. zealandica* (figure, but no description), Hudson (Element. Man. Insects N. Z., 1892).

There are doubtless very many species yet to be recorded from those countries.

Notes.

Corixa subjacens, Walker, in Tennant's Ceylon, i. (2nd ed.)

1859, p. 293, and Motschulsky, Bull. Soc. Moscou, xxxvi. (pt. 2) p. 94 (1863), appears to be merely a list name (as is also *Nepa minor*, Walk.), and I am not aware of any published descriptions; the same remarks probably apply to *C. lacustris* and *rivalis*, Stephens (Syst. Catal. Brit. Ins. ii. p. 354, 1829), Puton, Catal. Hém. faune paléarct. éd. 3 (1886), p. 66. nos. 54 and 55.

[Even if published, Walker's *Nepa minor* could not stand, as it is preoccupied by Palisot de Beauvois, Ins. rec. Afr. et Amér., 1803.]

Corixa cognata, D. & S. (Ent. Month. Mag. vi. p. 246, 1870), is preoccupied by Fieber (Europ. Hem. p. 99, 1861) [whose species equals *carinata*, C. R. Sahlberg], and therefore requires a new name. It seems to be a bug of exceedingly limited range, and restricted to Scotland; and as the researches of Thomson, Wallengren, the Sahlbergs, and Reuter have not revealed its presence in Northern Europe, I have no hesitation in proposing the name

4. "*caledonica*."

Fam. Notonectidæ.

5. *Notonecta Montandoni*, sp. n.

N. triguttatæ, Motschulsky, affinis, convexa; capitis vertice quam basi duplo latiore; oculorum marginibus lateralibus interioribus magis rectis quam apud *triguttatam*; pronoto anteriore subconstricto; tibiarum intermediarum calcari minuto; hemielytris punctatis.

Allied to *N. triguttata*, Motschulsky, and *chinensis*, Fallou (to the former in structure, to the latter in appearance and, in a less degree, structure), but larger and more robust anteriorly; *head* much broader and shorter; *vertex* a trifle more than twice as wide as the narrowest part of the head (near the base).

Head and *pronotum* sordid testaceous; *eyes* crimson; *pronotum* finely but deeply punctate posteriorly, superficially rugose anteriorly; *scutellum* black; *hemielytra* punctate, with sparse pale pubescence; dark crimson-lake, irregularly marked with black; as a rule the membrane is entirely, or almost entirely, black; in some specimens there are scarcely any spots at all on the clavus and corium, in others a broad undulatory band runs across the corium; embolium either entirely concolorous with the ground-colour of the hemielytra or blotched with black.

Pedes fusco-testaceous; intermediate tibial spur very small.

Ventral surface entirely black, except the connexivum, which is sordid testaceous, the junctures of the segments narrowly black.

Long. 16–16·7 millim.; lat. pronot. 6 millim.

Ngan Hoei, Ho-Chan (China): Montandon's collection and mine (kindly presented by Prof. Montandon). N. China: British Museum.

The species of the family Notonectidæ are exceedingly difficult to diagnose satisfactorily separately; the structural characters are very obscure and not always constant; moreover, such characters as the punctuation of the head and pronotum (which, in conjunction with others, are used so extensively in other families of the Rhynchota) appear to be quite valueless here. The coloration of the hemielytra as a diagnostic character is here not only valueless, but even misleading. Almost the only satisfactory method left is the comparative, and that ceases to be satisfactory when one does not possess the other species necessary for comparison!

Montandoni is structurally very close to both *triguttata* and *chinensis*; the hemielytra of the two latter, however, appear to be somewhat laterally sinuate and slightly dilated at the lateral margins of the corium, about one third of its length from its own apex; there is not the slightest trace of this in *Montandoni*.

In *chinensis* the head is very much narrower towards the base; from the base the lateral interior margins of the eyes keep almost parallel for a little space, then diverge (but not much); the vertex in this species is more than three times as wide as the narrowest part of the head (close to the base); in *triguttata* the head is wider basally than in *chinensis* and is not so widely divergent, the above-mentioned margins of the eyes are sensibly curved, and the vertex is a trifle more than two and a half times as wide as the narrowest part of the head; in *Montandoni* the head is wider both at the vertex and base, and the interior margins of the eyes are much straighter.

From the above notes it may perhaps appear that *Montandoni* is intermediate between *triguttata* and *chinensis*; but, from an exhaustive examination of a number of specimens of all three species, I am convinced that such is not the case; although *Montandoni* and *chinensis* are so similar in colour, it is rather *triguttata* that is the intermediate species.

I have much pleasure in dedicating this large and handsome species to my learned colleague Professor Montandon, who has helped in such a great degree, from his wide experience and extensive labours, to increase our knowledge of

the neglected aquatic Rhynchota. I am also indebted to Dr. Bergroth for kindly lending me the type of *N. chinensis*.

6. *Notonecta lactitans*, sp. n.

Gracilis, capitis vertice quam basi circiter quarto latiore, oculorum marginibus lateralibus interioribus fere parallelis; pronoto fere duplo latiore quam longiore.

Long and narrow; *vertex* about a fourth wider than the base of the head, interior lateral margins of the eyes almost parallel; *head* longitudinally subcarinate at the base; head and prothorax sordid testaceous; *pronotum* not quite twice as wide as long, punctate posteriorly, rugulose anteriorly; *eyes* brown. *Scutellum* black. *Metanotum* and *dorsal aspect of abdomen* shining black; genital segments blackish fuscous, margined with green. *Hemielytra* present a zebra-like appearance; clavus yellowish brown; corium yellowish brown, with a broad dark brown band along the base; membrane basally dark brown, apically yellowish brown; the exterior margin of the hemielytra is very narrowly pale.

Pedes apparently destitute of bristles, dark testaceous. *Venter* black.

Connexivum greenish.

In the specimen from Gaboon the left interior lobe is translucent, sordid white, and the scutellar and sutural margin of the clavus narrowly blackish brown.

Long. 12–12·5 millim.; lat. pronot. 4–3·4 millim.

Guinea: my collection. Gaboon: coll. Signoret, Hofmuseum in Wien). Africa (*Burchell*): British Museum.

The specimens in the British Museum are labelled "*lactitans*, Burchell." I have searched through the whole of the two vols. of Burchell's 'Travels' and through his other works, and can find no trace of any such name; I have therefore treated it as MS., but have used the name to prevent possible future confusion.

This species has no very close affinities with any other *Notonecta*; its long and slender form will at once distinguish it, aided by its curious zebra-colour; the structure of the head will place it in the neighbourhood of the American *N. insulata*, W. Kirby.

7. *Notonecta Uhleri*, sp. n.

Gracilis, angusta; capite parvo; oculis magnis, prominentibus, fere contiguis basin versus, marginibus lateralibus interioribus curvatis, late divergentibus verticem versus, capitis vertice 6–8plo latiore quam basi.

Somewhat of the size and form of *N. americana*, Fabr.,

but flatter and not so robust, narrower at the base of the hemielytra, the eyes much larger and more prominent, and the head smaller.

Eyes almost contiguous at their postero-interior angles, their interior lateral margins very curved, widely diverging towards the vertex, where the head is from six to eight times as wide as between the postero-interior ocular angles. *Head* and *pronotum* smooth, shining, pale rufo-testaceous; *eyes* reddish chestnut, irregularly bordered with black. *Antennæ*: two basal segments madder-brown, two apical segments rufo-testaceous.

Pronotum anteriorly somewhat rugose, with superficial sphærical depressions, posteriorly very finely punctate; humeral angles acute, accentuated; lateral margins sinuate, curved posteriorly below the humeral angles, forming almost a continuous line with the lateral margins of the scutellum; lateral margins distinctly and widely flattened anteriorly, the whole posterior half of the pronotum being elevated; posterior margin not sinuate.

Scutellum black, not pubescent; lateral margins very sinuate.

Connexivum (1) rufo-testaceous, each segment narrowly black at the apex, or (2) entirely green.

Hemielytra dark brick-red (or rich orange-yellow), with short, sparse, golden-yellow pubescence; a large irregular black blotch at the base of the corium and embolium extending transversely and non-acuminately from the apex of the clavus to the golden-yellow lateral submargin of the embolium; membrane dark red-brown, apical half black, this tint encroaching more or less upon the basal half.

Pedes rufo-testaceous or greenish; coxæ blackish, posterior tarsal fringe blackish and golden pink; all the spines and spurs on the legs black; unguiculi black; spur on intermediate tibiæ blunt, subcylindrical, two or three rudimentary spurs nearer the base; tibiæ and tarsi with four or five long, black, stiff hairs inferiorly; posterior femora with a double row of short spines inferiorly; tibiæ with short spines superiorly and inferiorly.

Ventral surface: *frons* emerald-green, anteriorly suffused with rose; apical segment of *rostrum* black, remainder rufo-testaceous, marginally darker.

Abdomen rufo-testaceous, densely furnished with blackish-green hairs; sternal hair-tufts golden pink.

Long., ♂ 11–11·4 millim., lat. 3·5–4 millim.

Long., ♀ 12 millim., lat. 4 millim.

The female is larger and apparently more robust than the male, as is the case with some other species of *Notonecta*.

Massachusetts and Florida: coll. Uhler. Massachusetts: British Museum. Massachusetts: Montandon's coll.

I have great pleasure in dedicating this handsome and remarkable species to the illustrious American Rhynchotist, to whose labours for the past forty years we are indebted in such large measure for our knowledge of, amongst other things, the North-American aquatic Rhynchota.

N. Uhleri is at once distinguished by the very peculiar form of the head and eyes, as above described; it is doubtless not uncommon over a large area of the United States.

N.B.—In connexion with the above descriptions it may be as well to remark that, contrary, perhaps, to the usage of some entomologists, I have used the word "transverse" in the sense of being *wider than long*: some rhynchotists, also, appear to use the word "*vertex*" as the equivalent of the *whole dorsal surface of the head* (excluding the eyes); I have restricted the term to the *apparent* (as seen from above) *apical margin of the head*; the head, moreover, will be found to be narrowest in most *Notonectæ* not *at* the base, but a trifle above it, between the postero-interior ocular angles in fact.

Summary.

Diaprepocoris, gen. nov.
D. barycephala, sp. n. Australia.
Corixa eurynome, sp. n. Australia.
—— *australis*, Fieb. Additional description.
—— *subjacens*, Walker. } Probably MSS. names.
—— *lacustris*, Stephens. }
—— *rivalis*, Stephens. }
Nepa minor, Walker. }
Corixa caledonica, nom. nov. for *C. cognata*, D. & S. (preoccupied).
Notonecta Montandoni, sp. n. China.
—— *lactitans*, sp. n. West Central Africa.
—— *Uhleri*, sp. n. North America.

VII.—*New Cyclostomatous Bryozoa found at Madeira.*

By James Yate Johnson, Corr.M.Z.S.

Tubuliporidæ.

Alecto simplex, J. Y. Johnson.

A very slender adnate thread, from the upperside of which rise the erect elongate cells in a single series. The adnate

stem is scarcely wider than the erect cells; it rarely divides dichotomously at the point where a cell arises, and it has not been seen to anastomose. The cells taper slightly upwards, are wrinkled transversely, and their mouths are circular. They are sometimes further apart, sometimes nearer each other, than the distance between them. Surface with white scattered granules. Oœcium not observed.

This form seems to differ from *A. granulata*, H. M.-Edw., of which a figure is given in Mr. Busk's Cat. Cyclost. Pol. B. M. pl. xxxii. fig. 1, where the adnate stem is represented as much thicker than the cells.

Horneridæ.

Hornera pectinata, Bk.

This rare bryozoon was shortly described by Mr. Busk in the Micr. Journ. for Jan. 1861, vol. i. (n. s.) p. 79, pl. xxxiii. figs. 4–6, and again in his Cat. of the Cyclost. Polyzoa B. M. from a specimen sent by me to him many years ago. A few perfect specimens having since occurred, I am able to give a fuller account of the species and to describe the oœcium, not hitherto known.

Colour greyish. Base spreading, trunk usually short and thick; branches terete, strong, extending fan-like, subpinnately, or irregularly; ultimate branches tapering. Anterior surface pierced by numerous oval pores, which are sunk in depressions and have slightly raised borders. Between the pores the surface is irregularly ridged. The pores on the dorsal surface are larger and are partially filled up inside. The ridges are here more distinctly pronounced, and are sinuous, meeting and separating so as to form a reticulation. The peristome is minutely dentate. The oœcia are dorsal, brownish, semiglobular, and the surface is thickly set with warts, each of which has a depression at the top with a perforation therein.

Three specimens were found on calcareous worm-cases attached to a Lithistid sponge (*MacAndrewia* or *Corallistes*). The largest specimen had a height of 21 millim. and a spread of 26 millim.

Diastoporidæ.

Diastopora catillus, J. Y. Johnson.

Zoarium circular or elliptical, seated on a thin calcareous base; the margin vertical. Centre cupped, the younger deeply so, with scarcely any free area; surface finely granular.

The radiating series of connate or partially free uniserial tubular cells are of different lengths; some begin at the centre and extend to the top of the vertical marginal wall, others are irregularly shorter. The innermost cells are very short, with oblique elliptical mouths, and some of them are free. The higher cells towards the margin have circular horizontal simple mouths. The walls of the cells and the spaces between them are transversely rugose. The margin of the zoarium rises steeply from the basal plate, and this boundary wall is entirely composed of the mouths of immersed cells to the number of four in a vertical series. Oœcia not observed.

This species is common on shells from deep water. The longer axis of the largest specimen I have seen measures 7 millim., excluding the basal plate, but the majority of my specimens are much smaller. In colour the younger ones are white, the older brownish.

Diastopora pulchella, J. Y. Johnson.

Cells distinct, erect, highest at the centre, gradually shorter towards the margin, which is low and thin; disposed quincuncially; mouths round, horizontal, simple. No adventitious tubules. Oœcia large, embracing several cells, inflated, semiglobular, finely granular, and punctate. Zoarium white hyaline.

The largest of my few specimens has a diameter of 3·5 millim. Three of them in beautiful condition are inside the valve of a *Lima*; others are on seaweed.

Lichenoporidæ.

(*Discoporellidæ*, Bk.)

Lichenopora spinata, J. Y. Johnson.

Zoarium circular, on a thin calcareous base, elevated, almost cylindrical, slightly concave at the centre. Cells distinct, uniserial, higher at the inner end, in radiating somewhat irregular series, long and short, four to six in a series. Mouths with four or five spines. In the vertical exterior wall are seen the mouths of about six immersed cells piled one above another. Central area studded with numerous spines and pierced by circular or suboval pores, the latter round at one end, angular at the other, the larger pores often partially filled up within. Surface of central area finely granular and punctate. One or two spines project horizontally from the lower part of some of the inner cells.

Between the radiating series of cells are one or two rows of pores.

A few examples of this small species were found upon a halichondrine sponge (*Petrosia*) which came from deep water off Madeira. The largest had a diameter of no more than 3 millim. Its place seems to be near *Lichenopora* (*Discoporella*) *fimbriata*, Bk. (Cat. Cyclost. Pol. B. M. p. 32, pl. xxvii.).

Radiopora irregularis, J. Y. Johnson.

White or brown, seated on a thin calcareous lamina. The zoarium usually consists of a central portion, around which extend subtriangular lobes, irregular as to their directions and relative sizes, but frequently giving to the whole something of the appearance of a starfish, such as *Asterina*, with short broad rays.

The central portion of the zoarium is raised and cupped, and the circumambient ridge is crossed by radiating series of upright connate cells. A depression runs along the middle of each exterior lobe, but stops short of the margin of the zoarium. Numerous series of cells are arranged at right angles to the median depression, and at the distal end of the lobe the series of cells radiate from the end of the furrow towards the margin.

The cells are upright, connate, and invariably form a single series. They are highest near the central cup and the depressions of the lobes; they gradually fall in height until they become immersed, and their mouths alone are shown at the margin of the zoarium. The mouth of the upright cells is prolonged into a mucro on the distal side, and sometimes on the opposite side also when the upper part of the cell is distinct. Round or oval pores varying in size occupy the central area and the lateral furrows. Between the series of cells there are two or three rows of pores.

There is much irregularity both as regards the outline and the superficies of this species: for instance, there are sometimes more intramarginal cups than one; at others there is no central cup at all; in some cases the central cup contains a short detached series of erect cells; a series of cells occasionally throws off a branch series or more than one.

The largest specimen I have seen has a diameter of 10 millim. This species has been found on seaweed and on *Pinna* shells, but the best examples were attached to the outside of a wine-bottle dredged in Funchal Bay.

From the above description it seems that Mr. Busk's definition of the genus (Cat. Cyclost. Polyzoa Brit. Mus.

p. 34) needs a little modification by the addition of the following clause at the end :—" or in lines extending at right angles to the direction of their elongate lateral troughs."

Frondiporidæ.

Frondipora maderensis, J. Y. Johnson.

Shortly stipitate, irregularly ramose; branches sometimes upright, usually spreading laterally and curving retrorsely, rarely meeting and uniting. The ultimate branches (tertiary or quaternary) are short and lobe-like.

The fasciculate cells open at the truncate ends of the upright branches and lobes; the orifices extend along the upperside of the lobes, but are not continued upon the branches. The orifices are pentagonal, and smaller ones are intermixed. The smallest lobes have only from one to three orifices; on others the orifices are seen in two connate series.

The branches are subtriquetrous, *i. e.* they are broader at the front than at the back. The anterior surface is obscurely granular; the posterior surface is faintly wrinkled transversely and is finely punctate reticulately. When fresh from the sea the zoarium is coloured a pale yellow, which fades to white.

The largest of the specimens rises vertically but a short distance above its base, and then spreads laterally 39 millim. in one direction and 27 millim. at right angles thereto. All the specimens, which have been many years in my possession, were either attached to dead individuals of the coral *Madracis asperula*, M.-E. & H., or were seated on sponges so attached. This coral is found in deep water off the coast of Madeira.

Reference may be made to Mr. Busk's figures of *Frondipora palmata*, Bk. (Cat. Cyclost. Pol. B. M. pl. xx. figs. 4, 5). The describer was not certain as to the locality from which his specimens came, but he believed they were brought from Australia.

The species now described differs from *F. palmata* in these respects:—(1) the fasciculi of orifices are not continuous along the branches, but are confined to the ultimate lobes; (2) the orifices do not open upon a raised portion of the horizontal branch or lobe, but open at once on the front of the lobe or at the ends of the upright branches; (3) Mr. Busk's fig. 5 represents the branch between the lobes with a pitted surface. In the new species no part of the branch is visible between the lobes, the front of the branches and lobes being, as stated above, broader in front than behind. No part of the zoarium has a pitted surface.

If this species is admitted into the genus *Frondipora*, Mr. Busk's definition of that genus should be modified thus :— Zoarium pedunculate ramose ; fasciculi opening only on one side, or at the ends, of the branches.

VIII.—*On Lepidoptera Heterocera from China, Japan, and Corea.* By John Henry Leech, B.A., F.L.S , F.Z.S., &c. —Part II. *Family* Geometridæ; *Subfamilies* Œnochrominæ, Orthostixinæ, Larentiinæ, Acidaliinæ, and Geometrinæ.

[Continued from vol. xix. p. 679.]

Genus Eupithecia.

(Curtis, Brit. Entom. vi. pl. lxiv. (1825).)

Eupithecia proterva.

Eupithecia proterva, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 445 (1878) ; Ill. Typ. Lep. Het. iii. p. 52, pl. liv. fig. 1 (1879).

A nice series from Yokohama in Pryer's collection.
Hab. Japan.

Eupithecia signigera.

Eupithecia signigera, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 442 (1879).

Specimens from Yokohama and Gifu in Pryer's collection.
Hab. Japan.

Eupithecia caliginea.

Eupithecia caliginea, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 445 (1878) ; Ill. Typ. Lep. Het. iii. p. 52, pl. liv. fig 2 (1879).
Eupithecia zibellinata, Christ. Bull. Mosc. lv. (2) p. 117 (1881).
Tephroclystis zibellinata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 66.

There were three specimens in Pryer's collection.
Distribution. Amur; Japan.

Eupithecia castigata.

Geometra castigata, Hübn. Geom. fig. 456.
Tephroclystis castigata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 66.

There were four specimens (one male, three females) in Pryer's Japanese collection. My native collector obtained the species at Nikko, and I have received it from Pu-tsu-fong, where specimens were taken in June.

Distribution. Europe ; Amur ; Japan ; Western China.

Eupithecia consortaria, sp. n.

Primaries greyish, with a faint brownish tinge and marked with darker on the costa; there are two or three obscure dusky transverse lines before the conspicuous black discal spot, and a double line (rather more clearly defined and angulated below costa) beyond the spot; submarginal line whitish, interrupted and bordered with dusky. Secondaries rather paler, with a blackish discal dot and an obscure dusky central band. Fringes greyish, marked with darker. Under surface pale fuscous grey; all the wings have a blackish discal dot, a dusky central band, and an obscure line beyond.

A male specimen from Moupin, July.

Hab. Western China.

Allied to *E. castigata*.

Eupithecia coronata.

Geometra coronata, Hübn. Geom. pl. lxxii. figs. 372, 373.
Eupithecia lucinda, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 442 (1879); Ill. Typ. Lep. Het. lx. pl. clxx. fig. 11 (1893).
Chloroclystis lucinda, Hampson, Fauna Brit. Ind., Moths, iii. p. 396 (1895).

Specimens from Yokohama in Pryer's collection.

Eupithecia excisa.

Eupithecia excisa, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 445 (1878); Ill. Typ. Lep. Het. iii. p. 52, pl. liii. fig. 11 (1879).
Chloroclystis palpata, Hampson, Fauna Brit. Ind., Moths, iii. p. 391 (1895).

Specimens from Yokohama, Gifu, and Yesso in Pryer's collection.

Hab. Japan and Yesso.

Eupithecia minuta.

Collix minuta, Butl. Trans. Ent. Soc. 1881, p. 421.

Three specimens from Yokohama in Pryer's collection.

Hab. Japan.

This species appears to be closely allied to *E. rectangulata*, Linn.

Eupithecia Julia.

Lobophora Julia, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 446 (1878); Ill. Typ. Lep. Het. iii. p. 53, pl. liv. fig. 4 (1879).
Chloroclystis palpata, Hampson, Fauna Brit. Ind., Moths, iii. p. 391 (1895).

There were specimens from Oiwake, Yokohama, Gifu, and Yesso in Pryer's collection.

Hab. Japan and Yesso.

Probably an Eastern Asian representative of *E. rectangulata*, L.

Eupithecia consueta.

Eupithecia consueta, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 442 (1879).

Five specimens from Yokohama and one from Yesso in Pryer's collection.

Hab. Japan and Yesso.

Eupithecia Pryeriaria, sp. n.

Male.—Pale whity brown. Primaries traversed by several pale brown, transverse lines, but these are only distinct on the costa; there is a pale brownish mark on the basal third of costa and a short oblique dash below it on the inner margin; discal dot black; outer marginal area of all the wings pale brown, traversed by a whitish wavy line. Under surface slightly suffused with fuscous; all the wings have a dusky border on outer margin.

Female.—Rather browner, and the transverse lines are more distinct.

Expanse 24 millim.

Three examples of each sex in Pryer's collection from Yokohama and Yesso.

Hab. Japan and Yesso.

Eupithecia fuscicostata.

Eupithecia fuscicostata, Christ. Rom. sur Lép. iii. p. 11, pl. i. fig. 6 (1887).

Eupithecia fuscostigma, Alph. *op. cit.* vi. p. 80 (1892).

Alphéraky records an example of each sex of this species from the province of Kan-sou, taken in July. He states that the specimens are paler and that there are fewer brownish markings on the disk of the wings.

Distribution. Transcaucasia; Western China.

Eupithecia Sophia.

Eupithecia Sophia, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 444 (1878) Ill. Typ. Lep. Het. iii. p. 51, pl. liii. fig. 9 (1879).

Butler describes this species from Yokohama; there were no specimens in Pryer's collection.

Hab. Japan.

Eupithecia invisa.

Eupithecia invis , Butl. Ann. & Mag. Nat. Hist. (5) i. p. 444 (1878); Ill. Typ. Lep. Het. iii. p. 51, pl. liii. fig. 10 (1879).

Butler's type was from Hakodate; Pryer did not meet with it, and I failed to obtain it in any part of Japan that I collected in.

Hab. Japan.

Probably a form of *E. castigata*, Hübn.

Eupithecia sinicaria, sp. n.

Primaries brownish, darker along the costa; the basal area is whitish, limited by a wavy whitish band, which is clearly defined on the dark costal area and is intersected transversely by a wavy dark line; there is another similar whitish band beyond the black discal dot, but this does not proceed below the middle of the wing; these bands are connected by an irregular whitish patch below the dark costal area; third band whitish, intersected by a dark line on costa, but hardly traceable below, except as white points on the nervules, submarginal line dusky. Secondaries greyish, traversed by five wavy whitish bands, the third and fourth of which are most distinct. Under surface fuscous grey; primaries with a black discal dot and indications of dusky transverse bands; secondaries with whitish bands as above.

Expanse 24 millim.

A male specimen from Che-tou, Western China: July.

Allied to *E. succentureata*, Linn., from Europe.

Eupithecia rufescens.

Eupithecia rufescens, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 445 (1878); Ill. Typ. Lep. Het. iii. p. 52, pl. liii. fig. 12 (1879).

Specimens from Yokohama in Pryer's collection. I took the species in Satsuma in May.

Hab. Japan and Kiushiu.

Eupithecia niphonaria, sp. n.

Primaries brownish, with some darker marks on the costa; discal dot black; submarginal line whitish, serrated to inner margin; there is a small white spot on it just above the inner margin. Secondaries rather paler, with a blackish discal dot and dusky indented central line. Fringes greyish, very broad, and preceded by a blackish line, which has pale dots on it at the ends of the nervules. Under surface paler

than above; primaries are slightly suffused with fuscous on the basal and outer marginal areas; the secondaries have two fuscous transverse lines, and all the wings have a blackish discal dot.

Expanse 22 millim.

A female specimen in Pryer's collection from Japan.

Allied to *E. absinthiata*, Cl., from Europe.

Eupithecia carearia, sp. n.

Pale brown. Primaries with a broad darker central band enclosing the blackish discal spot; the costal portion of the band above the discal spot is much darker than the remainder; there are indications of an interrupted pale submarginal line; this is preceded and followed on the costa by brownish clouds, and edged inwardly with the same colour above the middle and towards inner margin. Secondaries have a black discal dot. Fringes pale brown, preceded by an interrupted blackish line. Under surface paler than above, with blackish discal dots and faint traces of dusky transverse markings.

Expanse 25 millim.

Two male specimens in Pryer's collection.

Hab. Japan.

Allied to *E. indigata*, Hübn., from Europe.

Eupithecia costimacularia, sp. n.

Whitish. Primaries have four brownish spots on the costa, the first representing the upper portion of a basal patch, the second and third are near together, and the fourth is preceded by the whitish wavy line, which is inwardly bordered with brownish, especially towards inner margin; there are some brownish marks on the middle of the inner margin and the discal spot is elongate and black. Secondaries have a blackish discal dot; some brownish clouds on abdominal margin, from which there are indications of dusky bands across the wings. Fringes whitish, marked with brownish and preceded by a blackish line. Under surface whitish; primaries have the markings of upper surface faintly reproduced, except on inner margin; secondaries have a larger discal mark and two dusky transverse lines.

Expanse 24 millim.

One female specimen from Japan, probably from Yokohama.

Hab. Japan.

Allied to *E. oblongata*, Thnb., from Europe.

Eupithecia obliquaria, sp. n.

Primaries pale brown, basal and outer marginal areas clouded with blackish; there is an inwardly oblique and slightly angulated dark brown or blackish band about the middle of the wing; this is joined by an outwardly oblique streak on costal area; beyond the central band is a fine wavy blackish line, originating at costal extremity of central line and terminating in a spot on inner margin; submarginal line whitish and interrupted. Secondaries greyish; abdominal area pale brownish, barred with blackish. Fringes agree with the wings, preceded by a blackish line. Under surface greyish, suffused with fuliginous on primaries; secondaries have three dusky transverse lines; primaries have an elongate blackish discal mark and a spot of the same colour beyond it on costa.

Expanse 28 millim.

Two male specimens from Ta-chien-lu: May and June.

Hab. Western China.

Allied to *E. phœniceata*, Ramb., from Europe.

Eupithecia brevifasciaria, sp. n.

Primaries brownish; basal patch slightly darker, limited by a blackish line; central fascia indicated by blackish lines from costa to inner margin, the space between them blackish towards costa, forming a quadrate patch; beyond fascia is a pale band, whitish on costal portion, but suffused with the ground-colour below; outer marginal area with a blackish cloud on costa before apex, another below apex, and one at inner angle; these clouds are intersected by a whitish serrated submarginal line; there is a pale streak from apex to fascia. Secondaries whitish; the basal area is traversed by four blackish or fuscous bands, the outer one transversely intersected by a wavy line paler than ground-colour; outer marginal area fuscous, intersected by two whitish waved lines; the central space is paler than the ground, its outer edge crenulate. Fringes brown. Under surface whitish, tinged with fuscous; basal area traversed by diffuse fuscous lines and limited by a blackish line, angled at the middle; outer marginal area traversed by a fuscous line and limited by another line—the latter is marked with darker on neuration and is slightly curved on primaries and angled on secondaries; the intervening space on both wings, a spot about middle of outer margin of primaries, and a marginal band on secondaries paler than the ground-colour.

Expanse 28 millim.

One male specimen from Chow-pin-sa : May.
Hab. Western China.
Allied to *E. pulchellata*, Steph.

Eupithecia mandarinaria, sp. n.

Primaries pale brown, suffused and clouded with darker, and traversed by three black lines, each of which originates in a black mark on costa, and externally edged with whitish throughout its course; the inner is slightly curved, the outer is sharply dentate, and the median one is twice angled, the upper angle almost touching a dentation of the outer line; submarginal line wavy, whitish; discal spot black, encircled with whitish, large and conspicuous. Secondaries whity brown, dark brown on outer marginal area; there are two dusky transverse lines before the middle and a blackish-edged whitish dentate line beyond the middle, but this latter only extends from abdominal margin to third median nervule; submarginal line wavy, whitish. Fringes brown, marked with whitish and preceded by a whitish line. Under surface whitish, suffused with darker on the outer marginal area; primaries have a black discal spot, a black mark on costa beyond, and the transverse lines of upper surface are faintly indicated; secondaries have a black discal spot, some dusky transverse lines, and a series of blackish marks on the nervules.

Expanse 30–38 millim.

Fifteen specimens from Ta-chien-lu, Wa-shan, and Pu-tsu-fong, June; and one female example from Kiukiang.

Hab. Central and Western China.

In the Kiukiang example the transverse lines of primaries are very faint, but the black line beyond middle of secondaries is very conspicuous.

Allied to *E. togata*, Hübn.

Genus Microloba.

(Hampson, Fauna Brit. Ind., Moths, iii. p. 405 (1895).)

Microloba bella.

Melanippe bella, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 448 (1878); Ill. Typ. Lep. Het. iii. p. 55, pl. liv. fig. 10 (1879); Oberth. Etud. d'Entom. v. p. 53, pl. iv. fig. 11 (1880).
Tyloptera eburneata, Christ. Bull. Soc. Nat. Mosc. lv. (2) p. 116 (1880).
Microloba bella, Hampson, Fauna Brit. Ind., Moths, iii. p. 405 (1895).

There were specimens from Yokohama in Pryer's collection. I obtained the species at Gensan in July and at Hakodate in August, and my native collector met with it in the

island of Kiushiu. Examples have also been received from Ta-chien-lu, Pu-tsu-fong, Chia-ting-fu, and Chang-yang: June and July.

Distribution. Amur; Askold; Corea; Japan; Yesso; Kiushiu; Western and Central China.

Genus Brabira.

(Moore, Lep. Atk. p. 271 (1888).)

Brabira artemidora.

Melanippe artemidora, Oberth. Etud. d'Ent. x. p. 33, pl. i. fig. 6 (1884).
Brabira pallida, Moore, Lep. Atk. p. 271, pl. viii. fig. 12 (1887).
Brabira artemidora, Hampson, Fauna Brit. Ind., Moths, iii. p. 406 (1895).

Mr. Smith took two specimens at Hakone in August, and there were two in Pryer's collection.

Distribution. Sikhim (*Hampson*); Askold; Japan.

Brabira plicataria, sp. n.

Cinnamon-brown. Primaries have two short blackish streaks on costa before the broad central fascia, which has a darker patch on its middle; there are traces of a submarginal band, especially towards costa; these bands are continued on the secondaries; all the wings have a black discal dot. Fringes of the ground-colour, preceded by a series of black dots. Under surface tinged with fuscous, with bands of upper surface reproduced.

In the male the abdominal margin of secondaries is deeply folded.

Expanse, ♂ 27, ♀ 30 millim.

Two male specimens from Omei-shan and one female from Moupin: July.

Hab. Western China.

Superficially this species resembles *Venusia dharmsalæ*, Butl.

Genus Bessophora.

(Meyrick, Trans. Ent. Soc. Lond. 1892, p. 63.)

Bessophora Staudingeri.

Ptychoptera Staudingeri, Christ. Bull. Mosc. lv. (2) p. 83 (1881).
Bessophora Staudingeri, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 63.

I took two specimens at Gensan in June.

Distribution. Amur; Corea.

Ptychoptera being preoccupied in Diptera, Meyrick has changed the name of this genus to *Bessophora*.

Genus Lobophora.

(Curtis, Brit. Ent. ii. p. 81.)

Lobophora halterata.

Phalæna halterata, Hufn. Berl. Mag. iv. 608 (1769).
Geometra hexapterata, Schiff. Wien. Verz. 109 (1776); Hübn. Geom. fig. 232.
Trichopteryx hexapterata, Hübn. Verz. Schmett. p. 323.
Lobophora hexapterata, Steph. Ill. Brit. Ent., Haust. iii. p. 278; Guen. Phal. ii. p. 357.
Lobophora halterata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 62.

A few specimens from Yesso in Pryer's collection.
Distribution. Europe; Amur; Yesso.

Genus Trichopterigia.

(Hampson, Fauna Brit. Ind., Moths, iii. p. 403 (1895).)

Trichopterigia costipunctaria, sp. n.

Primaries pale brown, dotted with black on the costa; there is a blackish spot on the median nervure near the base; beyond there are two reddish spots, representing the first transverse band; central band reddish brown, interrupted between median nervure and costa, and intersected by some blackish marks on the nervules; submarginal band interrupted, reddish above inner margin. Secondaries whitish. Fringes agree in colour with the wings, preceded on primaries by a series of black dots (two at the extremity of each nervule). Under surface similar to above, but the markings of primaries are fuscous in colour.

Expanse 40 millim.

One male specimen and one female from Gifu in Pryer's collection.

Hab. Japan.

Genus Trichopteryx.

(Hübn.; Meyrick, Trans. Ent. Soc. Lond. 1892, p. 61.)

Trichopteryx volitans.

Lobophora volitans, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 446 (1878); Ill. Typ. Lep. Het. iii. p. 53, pl. liv. fig. 5 (1879).

A nice series from Yokohama in Pryer's collection.
Hab. Japan.

Trichopteryx hemana.

Larentia hemana, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 444 (1878); Ill. Typ. Lep. Het. iii. p. 51, pl. liii. fig. 8 (1879).

There was a nice series in Pryer's collection from Yokohama, and my native collector obtained the species in the island of Kiushiu.

Hab. Japan and Kiushiu.

Trichopteryx choaspitis.

Lobophora choaspitis, Oberth. Etud. d'Entom. x. p. 33, pl. i. fig. 10 (1884).

There was a specimen from Gifu in Pryer's collection that I consider to be referable to this species. Oberthür's type was from the isle of Askold.

Distribution. Askold; Japan.

Trichopteryx grisearia.

Lobophora grisearia, Leech, Entom., Suppl. p. 54 (May 1891).

Five males and three females, probably from Yokohama, in Pryer's collection.

Hab. Japan.

Trichopteryx terranea.

Lobophora terranea, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 446 (1878); Ill. Typ. Lep. Het. iii. p. 53, pl. liv. fig. 6 (1879).

Five specimens from Yokohama in Pryer's collection.

Hab. Japan.

Trichopteryx misera.

Lobophora misera, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 443 (1879).

There were nine specimens from Yokohama and one from Gifu in Pryer's collection.

Hab. Japan.

Trichopteryx bellaria.

Lobophora bellaria, Leech, Entom., Suppl. p. 54 (May 1891).

A male specimen from Yokohama and a female from Gifu in Pryer's collection.

Hab. Japan.

Trichopteryx viretata.

Geometra viretata, Hübn. Geom. pl. xliv. fig. 230.

Trichopteryx viretata, Hübn. Verz. Schmett. p. 323; Hampson, Fauna Brit. Ind., Moths, iii. p. 405; Meyrick, Trans. Ent. Soc. Lond. 1892, p. 62.

Lobophora viretata, Steph. Ill. Brit. Ent., Haust. iii. p. 278; Guen. Phal. ii. p. 368.

One female specimen from Ta-chien-lu, taken in May.

Distribution. Europe; Ural; Western China. Dharmsála; Sikhim; Khásis (*Hampson*).

Trichopteryx consobrinaria.

Lobophora consobrinaria, Leech, Entom., Suppl. p. 54 (May 1891).

One male specimen from Gifu in Pryer's collection.

This species is closely allied to *L. viretata*, Hübn.

Hab. Japan.

Trichopteryx obscuraria.

Lobophora obscuraria, Leech, Entom., Suppl. p. 55 (May 1891).

Several male specimens from Loochoo and Yokohama in Pryer's collection.

Hab. Japan and Loochoo.

Trichopteryx olivaria, sp. n.

Primaries olivaceous grey; costa marked with black; first line blackish, almost straight, and near the base of the wing; central band indicated by two black lines, connected below the middle by black bars on the nervules; the outer line is intersected by black bars on the neuration above the middle, bordered throughout its course with fuliginous, and terminates in a black patch, enclosing a white spot, on inner margin; submarginal band interrupted, blackish, followed by a wavy whitish line. Secondaries fuscous grey, with blackish discal dot. Fringes agree with the wings in colour, preceded by an interrupted black line. Under surface brownish grey on basal two thirds; outer marginal third paler, traversed by a dusky submarginal band; discal spot black, obliquely linear on primaries.

Expanse 35 millim.

One female specimen in Pryer's collection.

Hab. Japan.

Trichopteryx muscigera.

Lobophora muscigera, Butl. Trans. Ent. Soc. Lond. 1881, p. 421.

Pryer refers to this species in his Catalogue (564, Fujisan), but there were no specimens in his collection, and I have not seen any example other than the type in the National Collection at South Kensington.

Hab. Japan.

Genus Sauris.

(Guen.; Hampson, Fauna Brit. Ind., Moths, iii. p. 408 (1895).)

Sauris nigrilinearia, sp. n.

Primaries ochreous, with a faint greenish tinge; there are three black marks on the costa, and from each of these there are traces of transverse lines, the outer double and most distinct; on the outer marginal area there are two black transverse lines, the first curved and recurved and the second more or less interrupted; the space enclosed by these lines, from inner margin to above middle, fuscous grey, clouded with blackish; discal dot black, elongate; fringes greyish, darker at base, and preceded by a series of black dots. Secondaries fuscous grey. Under surface pale brown, with a pinkish tinge; outer marginal area of primaries suffused with dusky.

Expanse 34 millim.

One male specimen in Pryer's collection without locality ticket.

Hab. Japan.

Sauris nanaria, sp. n.

Primaries whitish, suffused with dusky on basal and costal areas, the latter tinged with ochreous; beyond the middle there is a broad, fuscous, transverse band—this is represented by a few scales only between the second median nervule and inner margin, and is edged outwardly on the costal area with whitish; outer marginal area blackish, interrupted exteriorly towards inner margin, and traversed by a thin line of the ground-colour; fringes greyish, preceded by a series of black dots. Secondaries fuscous grey. Under surface whitish, suffused with dusky on costal and outer marginal areas of primaries.

Expanse 20 millim.

One male specimen in Pryer's collection; locality not indicated.

Hab. Japan.

Genus Discoloxia.

(Warren, Novit. Zool. ii. p. 105 (1895).)

Discoloxia megaspilata.

Discoloxia megaspilata, Warren, Novit. Zool. ii. p. 105 (1895).

Warren describes this species from Japan. There was a nice series from Gifu in Pryer's collection.

Hab. Japan.

Genus Hydrelia.

(Hübn.; Hampson, Fauna Brit. Ind., Moths, iii. p. 412 (1895).)

Hydrelia sylvata.

Geometra sylvata, Hübn. Geom. fig. 231.
Phalæna testaceata, Donov. Brit. Ins. xiv. pl. cccclxxxvii. fig. 1 (1810).
Hydrelia sylvata, Hübn. Verz. Schmett. p. 322.
Asthena sylvata, Guen. Phal. i. p. 437.
Eucharea sylvata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 74.

Three specimens from Oiwake and two from Yokohama in Pryer's collection.

Distribution. Europe; Amur; Japan.

Hydrelia plenaria, sp. n.

Whitish grey. Primaries have a darker greyish band beyond the middle, transversely intersected by an interrupted line of the ground-colour, followed by a double greyish wavy line. Secondaries have six wavy greyish lines, but those on basal half are less distinct than those on outer half. Fringes greyish, preceded by an interrupted blackish line. Under surface whitish; primaries suffused with fuscous; all the wings have two dusky, wavy, transverse lines.

Expanse 21 millim.

Two male specimens from Chang-yang: June and August.

Hab. Central China.

Hydrelia phasma.

Emmelesia phasma, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 441 (1879).
Acidalia latsaria, Oberth. Etud. d'Entom. xviii. p. 32, pl. iii. fig. 35 (1893).
Hydrelia phasma, Hampson, Fauna Brit. Ind., Moths, iii. p. 412 (1895).

I took the species at Hakodate in August, and my native collector obtained it at Gensan in August and also in the island of Kiushiu. Eight specimens from Gifu, one from Yokohama, and one from Oiwake in Pryer's collection. Oberthür records the species from Ta-chien-lu.

Distribution. Japan; Yesso; Kiushiu; Western China; Corea.

Hydrelia nisaria.

Acidalia nisaria, Christ. Bull. Mosc. lv. 2, p. 49 (1881).

A fine series in Pryer's collection. The specimens are from Yokohama, Oiwake, and Gifu. I obtained the species at Gensan in July and at Hakodate in August.

Distribution. Amur; Japan; Yesso; Corea.

Hydrelia Blomeri.

Melanippe Blomeri, Curtis, Brit. Ent. pl. ccccxvi. (1832).
Emmelesia Blomeri, Steph. Ill. Brit. Ent., Haust. iv. p. 393.
Acidalia pulchraria, Eversm. Bull. Mosc. 1842, iii. p. 557.
Euchœca Blomeri, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 74.

One male specimen in Pryer's collection.

In this example the only character that shows up at all prominently is the short brownish fascia.

Distribution. Europe; Amur; Japan.

Hydrelia marmoraria, sp. n.

Primaries ashy grey; subbasal line black, followed by a diffuse brownish band; beyond this there is a black line shaded inwardly with brownish; this is angled to the black linear discal mark, and again towards inner margin, where it meets an elbow of a fascia composed of three black lines; the outermost of these lines has a bidentate projection; the whole of the apical area is clouded with reddish brown; submarginal line wavy, curved and recurved, blackish towards inner margin and outwardly edged with black about the middle. Secondaries brownish grey, with some dark transverse lines and whitish bands, but, with the exception of the interrupted outer white band, these are only clearly defined on abdominal area. Fringes whitish, preceded by a series of black spots. Under surface fuscous grey, with some of the black lines of upper surface reproduced. Secondaries whitish, with a blackish central line and a fuscous submarginal band; all the wings have a blackish discal dot.

Expanse 26 millim.

One male specimen from Chang-yang: August.

Hab. Central China.

Hydrelia luteata.

Geometra luteata, Schiff. Wien. Verz. p. 110.
Geometra lutearia, Hübn. Geom. fig. 103.
Asthena lutearia, Hübn. Verz. Schmett. p. 310; Guen. Phal. i. p. 435.
Euchœca luteata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 74.

There were two specimens, probably from Yokohama, in Pryer's collection; these are paler than the European examples in my collection.

Distribution. Europe; Amur; Askold; Japan.

Hydrelia ochrearia, sp. n.

Pale ochreous; all the wings have indications of subbasal,

central, and submarginal brownish lines, most conspicuous on the costa; the primaries have a brownish dot on costa between central and submarginal lines, and the secondaries have a brownish discal spot. Fringes of the ground-colour preceded by a series of minute black dots. Under surface whitish ochreous; primaries suffused with fuscous brown on costal portion of basal half; costa beyond tinged with darker ochreous.

Expanse 27 millim.

One male specimen from Pu-tsu-fong: June or July.

Hab. Western China.

Hydrelia straminearia, sp. n.

Pale stramineous. Primaries with four and the secondaries with three transverse dusky lines, the outer two in each case wavy and double; on the primaries there is a blackish dot at the costal extremity of the second and third lines; all the wings have a blackish discal dot. Under surface whitish; primaries tinged with stramineous on the apical and outer marginal areas, and clouded with fuscous on costal portion of basal area; there is an angulated and sinuous fuscous central line, and a double wavy line beyond also fuscous: secondaries have indications of two fuscous transverse lines; discal dots as above.

Expanse 33 millim.

One male specimen from Wa-shan: June.

Hab. Western China.

Hydrelia albidaria, sp. n.

White, with slight creamy tinge. Primaries have a black discal dot and four dusky, wavy, transverse lines, the third double; secondaries have three such lines, the middle one double. Under surface white; primaries fuscous on costal portion of basal area and traversed by three wavy fuscous lines, the central one well defined; secondaries have two fuscous lines; all the wings have a black discal dot, and the fringes are preceded by an interrupted blackish line.

Expanse 30–32 millim.

One male specimen from Chia-kou-ho, a female from Chia-ting-fu and one from Wa-shan: June and July.

I have described the female from Chia-ting-fu, as the markings are more distinct in this particular specimen than in either of the others.

Hab. Western China.

Hydrelia distinctaria, sp. n.

Whitish. Primaries traversed by five dark grey lines, the fourth double; costa has a broad ochreous streak, increasing in width towards outer margin; there is a blackish-grey mark at the base of costa and five others beyond, from the third, fourth, and fifth of which the second, third, and fourth transverse lines commence; the costal half of the double fourth line is clouded with blackish grey, and there are two spots of the same colour towards costa beyond fifth line and one on costa just before apex; discal spot black. Secondaries have three dark grey transverse lines, the second double; discal dot black. Fringes silky, preceded by blackish-grey dots towards apex of primaries and about the middle of secondaries. Under surface whitish; primaries have an elongate blackish patch at base and two irregular blackish bands beyond, extending from costa to second median nervule, whence they are continued as lines to inner margin: secondaries have lines of upper surface faintly reproduced.

Expanse 32 millim.

Two male specimens from Pu-tsu-fong and one from Wa-shan: June.

Hab. Western China.

Hydrelia recurvilineata.

Agnibesa recurvilineata, Moore, Lep. Atk. p. 256 (1887).
Hydrelia recurvilineata, Hampson, Fauna Brit. Ind., Moths, iii. p. 415 (1895).

I received a male specimen from Omei-shan, taken in July, and one from Chang-yang, taken in August.

Distribution. Sikhim (*Hampson*); Central and Western China.

Hydrelia punctilinearia, sp. n.

Somewhat similar to *H. recurvilineata*, but the orange markings are more restricted, the transverse lines of primaries are more clearly defined, and all the wings have a distinct submarginal line, macular or interrupted. The three lines on secondaries are finer, wider apart, and the two outer ones are dotted with black on the nervules.

Expanse 32–34 millim.

One male specimen from Chow-pin-sa, taken in June, and one from Kia-ting-fu, taken in July.

Hab. Western China.

Hydrelia pictaria.

Somatina (?) *pictaria*, Moore, Proc. Zool. Soc. Lond. 1867, p. 645.
Agnibesa pictaria, Moore, Lep. Atk. p. 256 (1887).
Hydrelia pictaria, Hampson, Fauna Brit. Ind., Moths, iii. p. 415 (1895).

I received two male specimens from Ta-chien-lu and a female from Wa-shan, all taken in July.

Distribution. Sikhim (*Hampson*); Western China.

Hydrelia electaria, sp. n.

Pale straw-yellow, traversed by obscure irregular lines. Basal area and costal portion of median third of primaries purplish, tinged with greyish; the basal area limited by a blackish curved line, edged with ferruginous, encloses an irregular patch of the ground-colour, and is traversed by an angulated blackish line; the costa beyond the limits of the basal patch is of the ground-colour, partially suffused with purplish; outer third ferruginous, merging into yellowish on apical area and towards inner margin, is limited by a lunulated blackish line and traversed by an obscure purplish-grey band; submarginal line represented by some blackish lunules, preceded by yellowish dots towards costa; a conspicuous black spot between the second and third median nervules and a smaller one in the space below. Secondaries have the abdominal margin tinged with ferruginous; outer third, which is of the ground-colour, merging into ferruginous towards the lunulated blackish limiting line, encloses a transverse series of greyish-ringed spots of the ground-colour, and is traversed by a tapered purplish-grey band; discal dot black. Fringes of the ground-colour with a brownish line at their base. Under surface pale whity brown: primaries have some fuscous marks on basal area and a conspicuous patch of the same colour on costal portion of median third; beyond there is a diffuse, fuscous, transverse band, followed by a blackish spot near apex, and a larger one between second and third median nervules: secondaries have a black discal dot, a fuscous transverse line, and a fuscous band, the latter traversed by a diffuse line of the ground-colour.

Expanse 35 millim.

One female specimen from Moupin: July.

Hab. Western China.

Hydrelia obliterata.

Geometra obliterata, Hufn. Berl. Mag. iv. p. 608 (1767).
Geometra hepararia, Hübn. Geom. pl. xi. fig. 58.

Euchœca hepararia, Hübn. Verz. Schmett. i. p. 298.
Eupisteria hepararia, Boisd. Ind. p. 192.
Euchœca obliterata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 74.

There was a male specimen from Fujisan in Pryer's collection.

Distribution. Europe; Japan.

Hydrelia angularia, sp. n.

Outer margin of all the wings angulated about middle. Pale brown, suffused with darker brown on primaries, especially towards base. Primaries have a purplish-brown curved and recurved line on outer marginal area, the portions of the outer margin below apex and above outer angle limited by this line are whitish brown. Secondaries have a fuscous transverse line, followed by a dusky shade before the middle and a brownish diffuse line beyond—the latter is followed by a series of blackish dots on the nervules; submarginal line purplish brown, very near to margin, and continued only from abdominal margin to third median nervule; all the wings have a black discal dot. Fringes pale brown, preceded by a blackish line, which is dentate on primaries and sharply so towards middle of secondaries. Under surface whitish, with blackish discal dots: primaries have a diffuse dusky subbasal band, a dusky band before the middle not extending to inner margin, and an angulated series of blackish dots on the nervules: secondaries have two interrupted dusky lines.

Expanse 34 millim.

Nine specimens from Gifu in Pryer's collection and one taken by myself at Nagasaki in May.

Hab. Japan and Kiushiu.

Genus Venusia.

(Curtis, Brit. Ent. vi. pl. dcclix (1839).)

Venusia cambrica.

Venusia cambrica, Curtis, Brit. Ent. pl. ccccxvi.; Meyrick, Trans. Ent. Soc. Lond. 1892, p. 75.
Venusia cambricaria, Guen. Phal. i. p. 440.

One female specimen from Oiwake in Pryer's collection.

Distribution. Europe; Japan.

Venusia tchraria.

Venusia tchraria, Oberth. Etud. d'Entom. xviii. p. 29, pl. iii. fig. 32 (1893).

Four male specimens were received from Pu-tsu-fong and one from Chow-pin-sa : June.

Oberthür's types were from Ta-chien-lu.

Hab. Western China.

Venusia kioudjrouaria.

Venusia kioudjrouaria, Oberth. Etud. d'Entom. xviii. p. 31, pl. iii. fig. 46 (1893).

Oberthür describes this species from Ta-chien-lu. I have four female specimens taken in the province of How-Kow in July.

Hab. Western China and Thibet.

Venusia laria.

Venusia laria, Oberth. Etud. d'Entom. xviii. p. 30, pl. iii. fig. 34 (1893).

Oberthür's types were from Ta-chien-lu. My collectors did not meet with the species.

Hab. Western China.

Venusia undularia, sp. n.

Primaries grey ; basal area with four serrated brownish-grey transverse lines ; beyond the blackish discal spot there are two undulated, serrated, brownish-grey lines, enclosing a band of the same colour ; the nervules passing through this band are marked with black, and there is a black bar on the band above the third median branch ; submarginal line agrees with the others in colour and contour, but increases in width towards the costa ; between the last line and the outer margin there is an indistinct dusky line. Secondaries whitish ; the discal dot is placed on or near a dark grey transverse shade, and there are four or five dark grey crenulated lines beyond. Fringes whitish grey, preceded by a series of blackish dots. Under surface of primaries fuscous, with the transverse lines beyond the discal spot faintly shown ; of secondaries as above.

Expanse, ♂ 30, ♀ 33 millim.

One example of each sex from Pu-tsu-fong, Western China : June.

This species is allied to *V. laria*, Oberth.

Genus ASTHENA.

(Hübn. ; Hampson, Fauna Brit. Ind., Moths, iii. p. 417 (1895).)

Asthena candidata.

Geometra candidata, Schiff. S. V. p. 110 ; Hübn. Geom. fig. 101.
Asthena candidata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 74.

I received seven specimens, including both sexes, from Chang-yang, taken in July, and I took the species at Ningpo in April and at Gensan in June. My native collector obtained it at Hakodate also in June.

Distribution. Europe; Amur; Japan; Yesso; Corea; Central and North-east China.

Asthena corculina.

Asthena corculina, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 400 (1878); Ill. Typ. Lep. Het. iii. p. 39, pl. l. fig. 8 (1879).

Several specimens from Yokohama in Pryer's collection. I took the species at Nagasaki in May.

Hab. Japan and Kiushiu.

Asthena ochrifasciaria, sp. n.

White, with ochreous transverse markings. Median band of primaries broad, bifurcate towards costa, its outer edge sinuous and its termination on inner margin clouded with blackish; this is preceded by three more or less curved narrow bands; outer marginal area traversed by a wavy double line; discal spot black. Secondaries with three ill-defined wavy bands. Fringes silky white. Under surface white; basal two thirds of primaries suffused with ochreous tinged with fuscous, limited by a darker sinuous line; outer marginal area traversed by two interrupted bands, which are intersected by the ochreous nervules: secondaries have four ill-defined bands; all the wings have a blackish discal dot.

Expanse 24 millim.

Six specimens, including both sexes, from Oiwake and Yokohama, in Pryer's collection.

Hab. Japan.

Asthena albostrigaria.

Cidaria albostrigaria, Brem. Lep. Ost-Sib. p. 85, pl. vii. fig. 13; Alph. Rom. sur Lép. vi. p. 79 (1892).

Cabera eliella, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 403 (1878); Ill. Typ. Lep. Het. iii. p. 43, pl. li. fig. 9 (1879).

Hydriomena albostrigaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 73.

Specimens in Pryer's collection from Nikko, Oiwake, and Yesso.

I took the species at Gensan in July, and my native collector at Hakodate in June and July. It appears to be common in Western China. Alphéraky records it from the province of Kan-sou, taken in July.

Distribution. E. Siberia; Amur; Japan; Yesso; Corea; Western China.

Asthena plurilinearia.

Somatina plurilinearia, Moore, Proc. Zool. Soc. Lond. 1867, p. 645.
Acidalia unistirpis, Butl. Ill. Typ. Lep. Het. ii. p. 51, pl. xxxvii. fig. 7 (1878); Alph. Rom. sur Lép. vi. p. 54 (1892).
Camptogramma unistirpis, Oberth. Etud. d'Entom. v. p. 54 (1880).
Asthena plurilinearia, Hampson, Fauna Brit. Ind., Moths, iii. p. 417, fig. 194 (1895).
Hydriomena plurilinearia, Meyrick, Trans. Ent. Soc. 1892, p. 73.

There was a nice series from Oiwake in Pryer's collection. I obtained specimens at Gensan in July and at Hakodate in August.

My collectors met with the species in all the localities in Western China that they visited, and also at Chang-yang: June and July. Alphéraky records it from the province of Szechuen, taken in August.

In some of the specimens from Wa-shan and Che-tou the white markings are very narrow, and there is an entire absence of dark lines or patches.

Distribution. N.W. Himalayas; Sikhim; Khásis (*Hampson*); Amur; Japan; Yesso; Corea; Askold; Central and Western China.

Asthena conditaria, sp. n.

Primaries pale brown, with darker transverse lines; basal area limited by a broad whitish band, which is elbowed below costa; between the central and outer marginal areas there is a broad whitish band, interrupted above the middle; a series of submarginal white dots placed on the nervules, discal spot black. Secondaries whitish, with traces of three waved transverse lines, most distinct on abdominal area. Fringes pale brown, chequered with darker. Under surface sordid white; basal two thirds of primaries suffused with fuscous; there is a pale brownish cloud before apex: secondaries have the markings more pronounced.

Eight specimens from Ta-chien-lu: May and June.

Expanse 38 millim.

Hab. Western China.

Asthena (?) *octomaculatia*, sp. n.

Silky white. Primaries have an irregular and diffuse ochreous band beyond the middle, the inner edge limited by an interrupted blackish line, which forms an 8-like mark about the middle. Secondaries have the basal two thirds ochreous, transversely interrupted by an ill-defined band of the ground-colour; on the outer marginal area there is a

narrow ochreous wavy band and indications of a submarginal line; discal dot blackish. Fringes silky white, preceded by three blackish dots towards apex. Under surface silky white: primaries have three dusky lines, each angled below the middle: secondaries have a minute discal dot and a dusky central shade.

Expanse 26 millim.

A male specimen from Chang-yang, August.

Hab. Central China.

Genus Eschatarchia.

(Warren, Novit. Zool. i. p. 395 (1894).)

Eschatarchia lineata.

Eschatarchia lineata, Warren, *l. c.*

I have been unable to see the type of this species, which Warren describes from Japan.

Genus Minoa.

(Treit. Schm. vi. 2, p. 248; Walk. Cat. Lep. Het. xxiv. p. 1048 (1862).)

Minoa murinata.

Phalæna murinata, Scop. Ent. Carn. p. 229 (1763).
Minoa euphorbiata, Treit. Schmett. vi. 2, p. 249 (1828).
Asthena murinata, Meyrick, Trans. Ent. Soc. 1892, p. 74.

One male specimen of the var. *cyparissaria*, Mann, from Oiwake, in Pryer's collection.

Distribution. Europe; Japan.

Genus Zola.

(Warren, Novit. Zool. i. p. 393 (1894).)

Zola terranea.

Ozola terranea, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 441 (1879).
Zola terranea, Warren, Novit. Zool. i. p. 393 (1894).

A fine series from Yokohama in Pryer's collection.

Hab. Japan.

Genus Pseudostegania.

(Butler, Trans. Ent. Soc. Lond. 1891, p. 416.)

Pseudostegania chrysidia.

Pseudostegania chrysidia, Butl. Trans. Ent. Soc. 1881, p. 417.

I took two specimens at Gensan in July, and Mr. Smith

one at Hakone in August. There was one example in Pryer's collection, and I have received one from Mr. Manley, of Yokohama.

Butler's type was from Tokio.

Hab. Japan and Corea.

Genus Hastina.

(Moore, Lep. Atk. p. 260 (1888).)

Hastina azela.

Erosia azela, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 403 (1878); Ill. Typ. Lep. Het. iii. p. 42, pl. li. fig. 6 (1879).

A nice series from Ohoyama and Oiwake in Pryer's collection. I also received eight specimens from Mr. Manley, of Yokohama.

Hab. Japan.

Genus Stamnodes.

(Guen. Phal. ii. p. 515 (1857).)

Stamnodes depeculata.

Cidaria depeculata, Led. Ann. Soc. Ent. Belg. xiii. pp. 40, 50, pl. ii. fig. 6, ♂ (1870).
Hydriomena depeculata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 72.
Stamnodes depeculata, Led., var. *thibetaria*, Oberth. Etud. d'Entom. xi. p. 35, pl. vi. fig. 44 (1886).

Occurs in most of the localities in Western China visited by my collectors.

Distribution. Armenia; Western China.

Genus Cambogia.

(Guen.; Hampson, Fauna Brit. Ind., Moths, iii. p. 419 (1895).)

Cambogia pulchella.

Hyria pulchella, Hampson, Ill. Typ. Lep. Het. viii. p. 124, pl. cliii. fig. 22 (1891).
Cambogia pulchella, Hampson, Fauna Brit. Ind., Moths, iii. p. 420 (1895).

One female specimen in Pryer's collection, probably from Yokohama.

Distribution. Sikhim; Khásis; Nilgiris (*Hampson*); Japan.

Cambogia pictaria.

Emmelesia pictaria, Moore, Lep. Atk. p. 267 (1887).
Cambogia pictaria, Hampson, Fauna Brit. Ind., Moths, iii. p. 420 (1895).

One female specimen, taken by my native collector at Gensan in July.

Distribution. Sikhim; Khásis; Ceylon (*Hampson*); Corea.

Cambogia phœnicosoma.

Chrysocraspeda phœnicosoma, Swinhoe, Ann. & Mag. Nat. Hist. xvi. p. 294 (1895).

Cambogia phœnicosoma, Hampson, Fauna Brit. Ind., Moths, iv. p. 561 (1896).

There were twelve specimens from Oiwake in Pryer's collection.

The type was from Cherra Punji. In the Japanese examples the band of primaries is paler than in typical examples.

Distribution. Cherra Punji; Japan.

Cambogia conspicuaria, sp. n.

Primaries pale purplish-brown, costa and marginal area pale stramineous; from the stramineous discal mark a brownish line proceeds to inner margin, and beyond this there are two leaden transverse wavy lines; the purplish portion of the wing is limited by a brownish bidentate line; submarginal line dusky. Secondaries pale purplish brown, suffused with ochreous on basal two thirds; pale stramineous beyond and at extreme base; there is a stramineous patch with a bifurcate black mark on it near the centre of the wing, and the purplish portion is traversed by two brownish lines and a pale one; submarginal line dusky. Fringes whitish, preceded by some brownish dots on the upper portion of the outer margin of each wing. Under surface fuscous grey, marginal areas whitish; limits of fuscous portion as above; the primaries have a pale discal mark centred with black, and the secondaries have a bifurcate black discal mark.

Expanse 28 millim.

One female specimen from Omei-shan, July.

Hab. Western China.

Genus Baptria.

(Hübn.; Meyrick, Trans. Ent. Soc. Lond. 1892, p. 80.)

Baptria brephos.

Odezia brephos, Oberth. Etud. d'Entom. ix. p. 22, pl. ii. fig. 3 (1884).

Occurred in all localities in Western China visited by my collectors, and also at How-Kow and Chang-yang: June and July.

The How-Kow specimens, two in number, are rather paler than any of the others in the series; the white band on primaries is narrower and is traceable to inner margin.

Distribution. Central and Western China; Thibet.

Baptria nigrilinearia, sp. n.

Primaries greyish brown, traversed by three blackish lines, the first not well defined, the second interrupted below the middle, the third angulated below costa and lobed at the middle, thence wavy to inner margin; the internal edge of the third line is broadly bordered with blackish, and the external edge bordered with whitish from costa to the lobe, and thence with greyish brown to inner margin; the area beyond is blackish, traversed by a wavy pale submarginal line, which unites with the third line at the lobe. Secondaries reddish orange, with three transverse black lines, all of which are interrupted towards costa; submarginal line indicated by a black spot on costa, and another, linear in shape, on abdominal margin; outer margin bordered with black. Fringes chequered whitish and blackish. Under surface pale reddish orange: primaries have the apex and outer margin black, separated on the costal area from a black transverse elbowed fascia by a short white band; on the basal half there are indications of two black transverse lines: secondaries have indications of two black lines on basal area, and beyond there is a black angulated fascia; the outer margin is black and between it and the fascia there is a short black bar from abdominal margin.

Expanse 32 millim.

Two male specimens and one female from Omei-shan, Western China: July.

Allied to *B. brephos*, Oberth.

Baptria discothyrata.

Erateina (?) *discothyrata*, Pouj. Ann. Soc. Ent. Fr. 1895, p. 315, pl. vii. fig. 21.

Poujade records one male specimen from Moupin. My collectors did not meet with this species.

Hab. Western China.

Genus Inurois.

(Butler, Ann. & Mag. Nat. Hist. (5) iv. p. 445 (1879).)

Inurois tenuis.

Inurois tenuis, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 445 (1879).

There was a series from Yokohama in Pryer's collection.

Hab. Japan.

Inurois membranaria.

Anisopteryx membranaria, Christ. Bull. Mosc. lv. 2, p. 73 (1881).
Erannis membranaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 81.

Of this species there was a series from Yokohama in Pryer's collection. It is no. 509 of his catalogue. The male is larger in size and paler in colour than the same sex of *I. tenuis*, and the discal spot on all the wings is more conspicuous.

Distribution. Amur; Japan.

Genus Anisopteryx.

(Stephens, Ill. Brit. Ent., Haust. iii. p. 151 (1829).)

Anisopteryx primigena.

Phthorarcha primigena, Staud., Meyrick, Trans. Ent. Soc. Lond. 1892, p. 80.
Anisopteryx primigena, Staud. Deutsche entom. Zeitschr., Lep. vii. p. 291 (1894).
Anisopteryx japonensis, Warren, Novit. Zool. i. p. 374 (1894).

Two male specimens from Yokohama in Pryer's collection.

Meyrick, who erected the genus *Phthorarcha* for the species, finds that *primigena* differs from the species included in *Anisopteryx*, Steph. (*Erannis*, Hübn., Meyrick), in being destitute of the middle pair of spurs on hind tibiæ and in vein 5 of secondaries being wholly absent. In both my specimens the fifth vein of secondaries is distinctly in evidence, but the middle spurs are not present on hind tibiæ.

Distribution. Samarkand; Japan.

Subfamily *Acidaliinæ.*

Genus Acidalia.

(Treit. Eur. Schmett. v. 2, p. 438 (1825).)

Section I. (Craspedia, Hampson).

Acidalia ornata.

Phalæna ornata, Scop. Ent. Carn. p. 219 (1763).
Leptomeris ornata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 89.
Craspedia ornata, Hampson, Fauna Brit. Ind., Moths, iii. p. 426 (1895).

Six specimens in Pryer's collection.

Distribution. Europe; Amur; Japan.

The blotches on outer area of the wings are less distinct in Japanese than in European specimens.

Acidalia propinquaria, sp. n.

White, dusted with brownish. All the wings have a blackish discal dot and a brown central line; outer marginal area brownish, limited by a wavy blackish line and transversely intersected by a wavy line of the ground-colour; this line is rather diffuse above the middle and towards outer angle. Fringes of the ground-colour preceded by a blackish lunulated line. Under surface white, suffused with fuscous on primaries, discal dot and outer line as above.

Expanse 25 millim.

Occurs at Moupin, Omei-shan, and in the province of Kwei-chow; also at Ichang and Chang-yang: June and July.

I took a female specimen at Gensan in July, and my native collector four males at Ningpo in the same month.

There is an unnamed example of the species from Hong-Kong in the National Collection at South Kensington.

Hab. Western, Central, and North-eastern China; Corea.

Acidalia satsumaria, sp. n.

White. Primaries have a faint fuscous band before the middle, marked with blackish on the inner margin, and a blackish angulated line beyond the middle; the latter becomes fuscous towards costa and is partly bordered outwardly with pale ochreous brown and blackish. Secondaries have a fuscous line beyond the middle, merging into black on abdominal margin, and dusky central shade; all the wings have a black discal dot. Fringes pale greyish white, with some fuscous dots at their base on primaries and towards outer angle of secondaries. Under surface whitish, with the markings of upper surface faintly reproduced.

Expanse 22 millim.

Two male specimens and one female taken by myself in Satsuma, May 1886.

Hab. Kiushiu.

Superficially resembles *A. trigeminata*, Haw.

Acidalia acutaria, sp. n.

Outer margin of secondaries distinctly angled about the middle.

Whity brown. Primaries have three transverse brownish lines: the first is not clearly defined, but has three black dots upon it; the second is oblique, indented towards the costa and again towards the inner margin; the third has a black mark upon it at inner margin and is dotted with black thence

to costa, where it is angled; submarginal line indistinct. Secondaries have two transverse lines, the outer one dotted with black; submarginal line indistinct; all the wings have a black discal dot. Fringes slightly darker than the ground-colour, preceded by black dots at the extremities of the nervules. Under surface: primaries irrorated with fuscous on basal half; second and third transverse lines distinct, the third dotted with black, but without black mark upon it: secondaries have the outer line as above, but the inner one is indistinct; discal spots as above.

Expanse 36–38 millim.

Four male specimens from Chang-yang and one example from each of the following localities:—Ichang, Kwei-chow, and Omei-shan: June.

Hab. Central and Western China.

Acidalia bimacularia, sp. n.

Whity brown. Primaries are traversed by five dusky wavy lines; the third of these passes through two dark brown marks, one on the inner margin and the other above third median nervule; the fourth and fifth lines are diffuse. Secondaries are traversed by a dusky diffuse central line; a wavy outer line and two dusky dentate bands beyond. All the wings have a brownish discal dot, that of secondaries placed on the central line. Fringes rather darker than the ground-colour, and preceded by a series of black dots connected by a fine dusky line. Under surface: primaries suffused with dusky; beyond the discal spot, which is linear, there is a faint blackish line and indented band: secondaries whitish, with a black discal dot and a blackish and wavy submarginal line.

Expanse 36 millim.

One example of each sex from Chow-pin-sa and a pair from Pu-tsu-fong: June.

Hab. Western China.

This species is closely allied to *C. Walkeri*, Butl.

Acidalia Walkeri.

Idæa Walkeri, Butl. Proc. Zool. Soc. Lond. 1883, p. 170.
Idæa extimaria, Moore, Lep. Ceyl. iii. p. 455, pl. cciv. fig. 5 (1887).
Craspedia Walkeri, Hampson, Fauna Brit. Ind., Moths, iii. p. 427 (1895).

I have specimens from Moupin, Ta-chien-lu, Omei-shan, Chang-yang, and Ichang: taken in June and July.

Distribution. Nilgiris; Ceylon; Khásis; Shán States (*Hampson*); Central and Western China.

Acidalia rivularia, sp. n.

Pale brown, finely irrorated with blackish. Primaries have three wavy dark transverse lines, the second diffuse and the third blackish, outwardly bordered with fuscous; discal spot annular, fuscous. Secondaries have two dark wavy transverse lines, the first diffuse and angled about the middle, the second blackish and bordered as on primaries; discal spot black. Fringes rather darker than the ground-colour and preceded by a series of black dots. Under surface paler than above; first line of primaries absent, but the other transverse lines are present, although not so well defined except as regards the outer blackish line on all the wings; discal spots black.

Expanse 40–42 millim.

Several specimens from Chang-yang and Moupin: July.

Hab. Central and Western China.

Acidalia proximaria, sp. n.

Pale whity brown. Primaries traversed by three darker lines, the first curved, the second wavy, the third elbowed below costa and edged inwardly with blackish above middle and towards inner margin, the area beyond third line suffused with greyish brown. Secondaries have two wavy transverse lines, the area beyond the second line greyish brown; all the wings have a discal dot, that on secondaries blackish. Fringes of the ground-colour, preceded by a blackish line. Under surface whitish; all the wings have two wavy dusky lines; basal area of primaries suffused with dusky.

Expanse 28 millim.

Three male specimens from Ichang, June and July.

Hab. Central China.

Somewhat similar to *A. bimacularia*, but much smaller; the outer margin of secondaries is hardly angled, and there is a central line on under surface of primaries.

Acidalia strigilaria.

Geometra strigilaria, Hübn. Geom. fig. 109.
Acidalia strigilata, Dup. Lép. viii. pl. clxxvii. fig. 1; Guen. Phal. i. p. 507.
Leptomeris strigilaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 89.
Acidalia strigilaria, Alph. Rom. sur Lép. vi. p. 54 (1892).

A common species in Japan; I captured it in various places from April to August. There were specimens from Yokohama in Pryer's collection. Occurs at Ningpo, Gensan, the island of Kiushiu, and at most of the places in China

visited by my collectors. Alphéraky records two specimens from the province of Kan-sou, taken in July.

Distribution. Europe; Amur; Japan; Kiushiu; Corea; Central, Western, and Northern China.

Acidalia modicaria, sp. n.

Somewhat similar to *A. strigilaria*, Hübn., but the oblique line of primaries terminates on the inner margin beyond the middle, and the outer marginal area of all the wings is dusky and is traversed by a conspicuous pale wavy line. The outer margins of secondaries are less angled.

Expanse 32 millim.

I took a male specimen at Foochau in April and have received one example of each sex from Omei-shan, taken in July, and a male from Kwei-chow, taken in August.

Hab. Eastern and Western China.

Acidalia falsaria, sp. n.

Whitish, powdered with greyish. Primaries have an indistinct discal dot and three transverse greyish-brown bands; the first is narrow, subbasal, and does not extend to costa, the second is angulated below costa, and the third is preceded by a darker wavy line and followed by a whitish one. Secondaries marked similar to the primaries, but the black discal dot is on the first band, which appears to be a continuation of the second of primaries. Fringes greyish, preceded by a blackish line. Under surface whitish, tinged with dusky on primaries; all the wings have a dusky submarginal line and obscure discal dot.

Expanse 32 millim.

I have specimens of this species from Ta-chien-lu, Chia-ting-fu, Pu-tsu-fong, and Chow-pin-sa: they were taken in June and July.

Hab. Western China.

Allied to *A. strigilaria*, Hübn.

Acidalia remotata.

Acidalia remotata, Guen. Phal. i. p. 458 (1857).
Acidalia attentata, Walk. Cat. Lep. Het. xxii. p. 754 (1861).
Acidalia absconditaria, Walk. *op. cit.* xxiii. p. 757 (1861); Butl. Ill. Typ. Lep. Het. iii. p. 40, pl. l. fig. 12 (1879).
Craspedia remotata, Hampson, Fauna Brit. Ind., Moths, iii. p. 433 (1895).

This species occurred throughout the region here dealt with from April to September.

There is considerable variation in expanse, colour, and markings; the various forms are connected by intergrades.

Distribution. Formosa; throughout India, Ceylon, and Burma; Andamans; Borneo (*Hampson*); China; Japan; Corea.

Acidalia fumata.

Acidalia fumata, Steph. Ill. Brit. Ent., Haust. iii. p. 312 (1835).
Leptomeris fumata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 89.

One female specimen in Pryer's collection appears to be referable to this species.

Græser (Berl. ent. Zeit. 1888, p. 389) records the species from Amurland.

Distribution. Europe; Amur; Japan.

Acidalia remutaria.

Geometra remutaria, Hübn. Geom. fig. 98.
Leptomeris remutaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 89.

One female specimen in Pryer's collection.

Distribution. Europe; Amur; Japan.

Acidalia arenaria, sp. n.

Pale sandy brown, sparingly dusted with fuscous. Primaries have three transverse lines similar to those of *A. remutaria*, but they are less wavy and the first is placed midway between the base of the wing and the second line. Secondaries have two transverse lines. Fringes silky, preceded by a thin dusky line, upon which there is a black spot (sometimes two spots) just below apex. Under surface similar to that of *A. remutaria*, but the markings, especially on the secondaries, are less distinct.

Expanse 21–28 millim.

I took this species at Ningpo in April and at Nagasaki in May; my native collector obtained it at Gensan in July and also in the island of Kiushiu.

Several specimens received from Chang-yang, June.

Allied to *A. remutaria*, but the outer margin of primaries is rounder.

Distribution. Central and Northern China; Kiushiu; Corea.

Acidalia Beckeraria.

Acidalia Beckeraria, Led. Gen. p. 94 (1853); Alph. Rom. sur Lép. vi. p. 54 (1892).

Alphéraky records a male specimen from Yan-mine-Guagne, in the province of Chan-Si, captured in June.

Distribution. Western and Central Asia; Western China.

Acidalia nemoraria.

Acidalia nemoraria, Hübn., var.?; Alph. Rom. sur Lép. vi. p. 54 (1892).

Alphéraky records a male specimen from Ou-pin in the province of Kan-sou: July. He states that the wings are very white, and that the ochreous bands are more distinct, especially on the secondaries, than in the European type.

Distribution. Central and Eastern Europe; Amur; Western China.

Acidalia nivearia, sp. n.

Male.—White. Primaries have three oblique pale ochreous transverse lines; the first of these is not well defined, but the second and third are parallel and near together; the costa of primaries and outer marginal area of all the wings sparingly sprinkled with minute black specks (only discernible under a lens). Secondaries have two almost parallel pale ochreous transverse lines and a black discal dot. Under surface white: primaries suffused with fuscous on costal portion of basal half; parallel transverse lines pale brown: secondaries have a pale brown transverse line beyond the middle and a minute black discal dot.

Female.—White, with minute black specks on costa of primaries and outer marginal area of all the wings as in the male; the wings appear to be without transverse markings.

Expanse, ♂ 22, ♀ 18 millim.

One example of each sex in Pryer's collection.

Hab. Japan.

Acidalia strigaria.

Geometra strigaria, Hübn. Geom. pl. xviii. fig. 95.
Acidalia strigaria, Guen. Phal. i. p. 497.
Leptomeris strigaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 89.

There were some specimens from Oiwake in Pryer's collection, and I took a nice series at Gensan in June and July.

Distribution. Europe; Amur; Corea; Japan.

Acidalia majoraria, sp. n.

Male.—Allied to *A. umbelaria*, Hübn. Whitish, powdered with fuscous scales. Primaries have four pale brown transverse lines, the first of which is elbowed below costa, the second is oblique, the third and fourth (which are near together) are oblique and slightly wavy. Secondaries have three transverse lines, which appear to be continuations of the second, third, and fourth of primaries. Fringes whitish,

silky and rather long. Under surface whitish: primaries heavily powdered with fuscous except on inner margin; costa tinged with ochreous; second, third, and fourth transverse lines indicated: secondaries sparingly powdered with fuscous, transverse lines hardly indicated; discal dot sometimes present, but never clearly defined.

Female.—Transverse lines rather broader and more distinct, otherwise agreeing with the male.

Expanse 40–42 millim.

Seven male specimens and two females from Oiwake in Pryer's collection.

Hab. Japan.

Acidalia umbelaria.

Geometra umbelaria, Hübn. Geom. figs. 437, 438.
Leptomeris umbelaria, Hübn. Verz. Schmett. p. 310; Meyrick, Trans. Ent. Soc. Lond. 1892, p. 89.
Acidalia umbelaria, Guen. Phal. i. p. 502; Alph. Rom. sur Lép. vi. p. 54 (1892).

Five male specimens from Ta-chien-lu and two females from Moupin, taken in June. Alphéraky records two specimens from Yan-mine-Guagne in the province of Chan-Si, taken in June.

Distribution. Europe; Altai; Amur; Western China.

Acidalia sedataria, sp. n.

Male.—White. Primaries have three brownish-grey oblique transverse lines, one before and two beyond the middle. Secondaries also have three transverse lines, the first and second appearing to be continuations of the second and third of primaries. Under surface white: primaries suffused and dusted with fuscous on basal two thirds, and with two parallel fuscous transverse lines beyond the middle: secondaries have one fuscous transverse line beyond the middle; all the wings have a minute black discal dot.

Female.—Powdered and slightly suffused with brownish grey, and the transverse lines are diffuse.

Expanse, ♂ 32, ♀ 28 millim.

Allied to *A. umbelaria.*

Five male specimens and one female from Ta-chien-lu, one male from Chia-ting-fu and one from Pu-tsu-fong: June.

Hab. Western China.

Acidalia pudicaria.

Cabera pudicaria, Motsch. Bull. Mosc. 1860, p. 36.

There was a series from Oiwake and Yokohama in Pryer's

collection. I obtained the species at Gensan in July, and my native collector took specimens at Hakodate in the same month.

I have received examples from Chang-yang and Chia-kou-ho.

Distribution. Amur; Japan; Yesso; Corea; Central and Western China.

Acidalia superior.

Asthena superior, Butl. Ill. Typ. Lep. Het. iii. p. 39, pl. l. fig. 9 (1879).

A series from Yokohama and Oiwake in Pryer's collection.

I captured specimens at Ningpo in April, at Tsuruga and Gensan in July. My native collector took the species at Ningpo in June and also in the isle of Kiushiu. I have received specimens from Chang-yang, Ichang, and Omei-shan, where they were taken in June and August.

Distribution. Japan; Kiushiu; Corea; Central, Western, and Northern China.

Acidalia nupta.

Asthena nupta, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 401 (1878); Ill. Typ. Lep. Het. iii. p. 39, pl. l. fig. 6 (1879).

There were some specimens in Pryer's collection. I obtained the species at Fusan in June, and my native collector met with it in the island of Kiushiu.

Distribution. Japan, Kiushiu, and Corea.

Acidalia pulveraria, sp. n.

White, powdered with greyish. Primaries have an oblique dusky diffuse line just beyond the middle and a more distinct dusky waved line parallel with the outer margin; the space between these lines is less powdered with greyish than the rest of the wing; submarginal line white and wavy. Secondaries with markings as on primaries. Fringes greyish, preceded by an interrupted blackish line. Under surface whitish: primaries suffused with fuscous, except on inner and outer margin, dusky lines as above: secondaries have a black discal dot and an obscure dusky transverse line beyond the middle.

Expanse 22–30 millim.

One example of each sex from the island of Kiushiu, taken in June, and I took seven specimens in Satsuma in May. There were two males in Pryer's collection.

Hab. Japan and Kiushiu.

Allied to *A.* (*Idæa*) *peralba*, Swinh.

Acidalia marcidaria, sp. n.

Whitish. Primaries suffused with pale ochreous brown on basal half; beyond the middle there is a wavy transverse line limiting the outer marginal area, which is ochreous brown, traversed by an interrupted band of the ground-colour. Secondaries have subbasal and median ochreous-brown bands; outer marginal area as on primaries. All the wings have a black discal dot. Fringes rather paler than the markings, preceded by wavy whitish line. Under surface whitish: primaries freckled and suffused with fuscous on basal and outer marginal areas; there is a dusky, wavy, transverse line beyond the middle, which is continued on the secondaries.

Expanse 28–33 millim.

Five male specimens and one female from Wa-shan, three males from Chia-ting-fu and one from Ta-chien-lu: June and July.

Hab. Western China.

In some examples the basal area of primaries is limited by a darker line and in others the wing is not suffused within this line.

Acidalia lutearia, sp. n.

Pale ochreous, finely powdered with fuscous. Primaries have a subbasal and two median wavy dusky lines, the space between the latter not powdered with fuscous; submarginal band wavy, of the ground-colour, free from fuscous powdering. Secondaries with lines and bands similar to those of primaries. Fringes of the ground-colour, with some black dots at their base towards apex of primaries. Under surface whitish: primaries have the outer third fuscous grey, limited by a serrated darker line, and traversed by a wavy pale band; there is a central transverse fuscous-grey shade, enclosing the pale-ringed black discal dot: secondaries have an obscure transverse subbasal band, a dark wavy central line, and an ill-defined dusky submarginal band; fringes of all the wings pale brown, preceded by a series of black dots.

Expanse 34 millim.

Eight male specimens and one female from Ichang and Chang-yang: June.

Hab. Central China.

Acidalia confusa.

Asthena confusa, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 400 (1878); Ill. Typ. Lep. Het. iii. p. 39, pl. l. fig. 7 (1879).

I took this species at Nagasaki and in Satsuma in May;

my native collector obtained it at Gensan in July, and also at Nikko and in the island of Kiushiu. There was a specimen from Oiwake in Pryer's collection, and I have received one from Mr. Manley taken at Yokohama. The latter locality is also given for the species by Pryer in his 'Catalogue.'

Distribution. Japan; Kiushiu; Corea.

Acidalia plumbearia.

Acidalia plumbearia, Leech, Entom., Suppl. p. 55 (May 1891).

I took a male specimen in Satsuma in May and a female specimen at Nagasaki in June.

Hab. Kiushiu.

Acidalia mendicaria, sp. n.

Leaden grey. Primaries have three more or less wavy darker transverse lines; submarginal line paler; all the wings have a dusky discal mark. Fringes rather paler than the ground-colour. Under surface paler than above, the only marking is an indistinct dusky submarginal line on each wing. Antennæ fasciculate, vertex of head conspicuously white.

Expanse 33 millim.

One male and two female specimens from Chang-yang and one male from Moupin: July.

Hab. Central and Western China.

Allied to *A. plumbearia* and also to *A.* (*C.*) *mecysma*, Swinh.

Acidalia centrofasciaria, sp. n.

Pale ochreous brown. Primaries have two transverse lines and a median band; the inner line dusky, angulated below the middle; outer line wavy, pale ferruginous; the median band is diffuse and purplish brown in colour, this band and also outer line are continued on the secondaries; all the wings have a blackish discal spot, obscured by the band on secondaries. Under surface paler than above, with all markings faintly reproduced, and the costal portion of basal area of primaries tinged with purplish grey.

Expanse 32 millim.

One female specimen from Chang-yang, June.

Hab. Central China.

Acidalia farinaria, sp. n.

Whitish, irrorated with greyish brown. Primaries have three and the secondaries two wavy, dusky, transverse lines; all the wings have an indistinct discal dot and whitish sub-

marginal line. Fringes whitish, preceded by a series of small blackish lunules. Under surface whitish: the primaries are suffused with greyish brown and are traversed by two dusky wavy lines beyond the discal mark: the secondaries also have two transverse lines, but the inner one is not well defined.

Expanse 32 millim.

One female specimen from Chia-ting-fu, July.

Hab. Western China.

Acidalia gnophosaria, sp. n.

Primaries pale ochreous brown, traversed by three wavy fuscous lines, each expanding into a blotch on costa; the marginal area beyond the third line is leaden grey, traversed by an undulated pale band. Secondaries leaden grey, heavily powdered with fuscous and traversed by two dusky lines; outer marginal area as on primaries. All the wings have a black discal dot. Fringes pale ochreous brown, preceded by a black lunulated line. Abdomen fuscous, ringed with pale brown. Under surface leaden grey; fringes pale brown.

Expanse 36 millim.

One male specimen from How-Kow, Thibet: July.

Allied to *A. marginepunctaria* from Europe.

Acidalia hanna.

Acidalia hanna, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 401 (1878); Ill. Typ. Lep. Het. iii. p. 40, pl. l. fig. 11 (1879).

There were specimens in Pryer's collection. I obtained two examples at Fusan in June.

Hab. Japan and Corea.

Acidalia impersonata.

Acidalia impersonata, Walk. Cat. Lep. Het. xxiii. p. 758 (1861).

There were some specimens from Yokohama in Pryer's collection. I took the species in Satsuma and at Nagasaki in May and at Gensan in July, and I have received specimens taken in August at Ichang. "China" is the locality given by Walker for the type.

Distribution. Japan; Kiushiu; Corea; Central and Northern China.

Acidalia infuscaria, sp. n.

Male.—Dusky brown. Primaries have four darker transverse wavy lines, the third and fourth outwardly bordered with paler. Secondaries have transverse lines as on pri-

maries. Under surface similar to above, but suffused with fuscous.

Expanse 24 millim.

Female.—Pale ochreous brown, transverse lines indistinct.

Allied to *A. rubiginata*, Hufn.

Several specimens in Pryer's collection, some of which are from Yesso; my collector obtained one female at Ningpo in July. I received one male from Chang-yang, taken in June.

One of the Japanese examples is almost unicolorous dark brown, with a slight purple tinge.

Distribution. Japan; Yesso; North and Central China.

Acidalia obfuscaria, sp. n.

Fuliginous brown on both surfaces, with rather lighter fringes; all the wings have faint traces of darker transverse lines beyond the middle. Body agrees with the wings in colour, but the tip of the abdomen is lighter.

Expanse 24 millim.

Two male specimens taken by my native collector at Ningpo in June.

Hab. North-eastern China.

Acidalia tectaria, sp. n.

Pale ochreous. Primaries have three and the secondaries two slightly darker irregular transverse lines. Fringes silky. Under surface: primaries pale ochreous, with lines of upper surface indicated: secondaries paler, with two obscure transverse lines.

Expanse 24–28 millim.

Ten specimens, mostly males, from Chang-yang: June. I obtained two examples at Gensan in July.

Distribution. Central China; Corea.

Acidalia cineraria, sp. n.

Ashy grey, powdered with dark grey. Primaries have three transverse dark grey bands; the first is narrow and indented before reaching inner margin, the second is waved and broad below the blackish discal spot, the third is broad, wavy, and limited inwardly by a blackish line. Secondaries have a dark grey band before the blackish discal spot, and another, preceded by a blackish line, beyond; the first is angled about the middle and the second is dentate on its outer edge. Fringes of the ground-colour preceded by an interrupted black line. Under surface whitish grey, suffused with darker grey on basal and outer marginal areas.

Expanse 24–26 millim.

The first and second bands of primaries are not always clearly defined, and in some specimens the markings are almost obsolete.

I took a series at Nagasaki and in Satsuma in May and a single example at Fusan in June, and one at Gensan. I have also received the species from Yokohama, taken by Mr. Manley.

Allied to *A. accurataria*, Christ.

Distribution. Japan; Kiushiu; Corea.

Acidalia macescens.

Acidalia macescens, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 439 (1879).

A series from Yokohama and Oiwake in Pryer's collection. I obtained the species at Nagasaki and in Satsuma in May. My native collector took specimens at Gensan in July, and I have received others from Chang-yang, captured in June and July, and from Ichang, taken in August.

Distribution. Japan; Kiushiu; Corea; Central China.

Acidalia emissaria.

Acidalia emissaria, Walk. Cat. Lep. Het. xxii. p. 751 (1861).
Lycauges lactea, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 373 (1879).
Craspedia emissaria, Hampson, Fauna Brit. Ind., Moths, iii. p. 435 (1895).

I obtained this species at Foochau and Ningpo in April, and there was a series of specimens from Yokohama in Pryer's collection.

Distribution. Dharmsála; Moulmein; Ganjam (*Hampson*); Japan; Northern China.

Acidalia steganioides.

Acidalia steganioides, Butl. Ill. Typ. Lep. Het. ii. p. 51, pl. xxxvii. fig. 8 (1878).

There was a fine series from Yokohama in Pryer's collection; I met with specimens at Gensan in July, and my native collector obtained the species in the island of Kiushiu.

Distribution. Japan; Kiushiu; Corea.

Some examples are almost uniformly dark brown, with the markings obsolescent.

Acidalia (?) *tchratchraria.*

Acidalia tchratchraria, Oberth. Etud. d'Entom. xviii. p. 32, pl. iv. fig. 60 (1893).

Oberthür's type was from Tâ-Tsien-Loû. My collectors did not meet with the species.

Hab. Western China.

Section II. (Eois, Meyrick).

Acidalia muricata.

Phalæna muricata, Hufn. Berl. Mag. iv. p. 606 (1769); Rott. Naturf. xi. p. 81.
Geometra auroraria, Bork. Eur. Schmett. v. p. 477 (1794); Hübn. Geom. fig. 63.
Eois muricata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 87.

There was a nice series from Yokohama, Oiwake, and Nikko in Pryer's collection. I took the species in Satsuma in May and at Fusan in June. I have also received specimens from Chang-yang and Ichang, where they were taken in June and August.

Distribution. Europe; Amur; Japan; Kiushiu; Corea; Central China.

Acidalia sinicata.

Hyria sinicata, Walk. Cat. Lep. Het. xxii. p. 668 (1861); Butl. Ill. Typ. Lep. Het. iii. p. 41, pl. li. fig. 3 (1879).

Walker describes this species from "China (*T. Laye*)," but the exact locality is not indicated.

Acidalia contiguaria.

Geometra contiguaria, Hübn. Geom. pl. xx. fig. 105.
Acidalia contiguaria, Dup. Lép. v. 59, pl. clxxiv. fig. 1.
Eois contiguaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 87.

This species occurs in Corea and at Chang-yang and Chow-pin-sa.

Distribution. Europe; Corea; Central and Western China.

Acidalia impexa.

Acidalia impexa, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 438 (1879).

There was a nice series from Yokohama in Pryer's collection. I obtained the species in Satsuma in May and my native collector at Gensan in July.

Distribution. Japan; Kiushiu; Corea.

Acidalia latimarginata.

Eois latimarginata, Warren, Novit. Zool. ii. p. 95 (1895).

One specimen from Ichang, June.
Warren's type is recorded from Japan.

Distribution. Japan; Western China.

Acidalia roseolimbata.

Acidalia roseolimbata, Poujade, Ann. Soc. Ent. Fr. 1895, p. 310, pl. vi. fig. 9.

Poujade's type was from Moupin. I have received specimens from Wa-shan, Ni-tou, Ta-chien-lu, and Pu-tsu-tong, taken in June and July.

Hab. Western China.

Acidalia jakima.

Acidalia jakima, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 401 (1878); Ill. Typ. Lep. Het. iii. p. 40, pl. l. fig. 10 (1879).

Specimens in Pryer's collection. I have received examples from Yokohama, Gensan, and Chang-yang.

Var. *obliteraria*, nov.

Transverse lines on upper surface obsolete, outer margins bordered with rosy; on the under surface the transverse lines are as in type, but less clearly defined.

One female specimen taken by myself in Satsuma, May.

Distribution. Japan; Kiushiu; Corea; Central China.

Acidalia fœdata.

Acidalia fœdata, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 439 (1879).
Acidalia salutaria, Christ. Bull. Mosc. lv. (2) p. 51 (1881).
Lois salutaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 87.

Several specimens from Yokohama and Oiwake in Pryer's collection. I took the species at Shimonoseki and Tsuruga in July, and have received it from Ichang, where it was taken in August, and also from Gensan and Hakodate.

Distribution. Amur; Japan; Yesso; Corea; Central China.

Acidalia promiscuaria, sp. n.

Whitish, powdered on costal area with darker, and faintly iridescent. All the wings have a dusky central band, but this is not well defined, and there are other transverse markings beyond, but these are still more obscure. Under surface coloured as above: primaries have a dusky discal mark.

Expanse 28 millim.

I obtained a female specimen at Fusan in June.

Hab. Corea.

Acidalia obtectaria, sp. n.

Pale ochreous, with irregular darker transverse markings, a band beyond middle of primaries being the most prominent. Fringes of the ground-colour. Under surface paler than above and the markings more obscure.

Expanse 19–21 millim.

Allied to *A. bisetata*, Hufn., but more ochreous in colour, and the markings more confused.

Five specimens in Pryer's collection.

Both sexes are represented, but the above description is taken from a female example, as it is in better condition than the other specimens.

Hab. Japan.

Acidalia bisetata.

Phalæna bisetata, Hufn. Berl. Mag. iv. 618 (1769).
Geometra bisetata, Bork. v. 524 (1794).
Acidalia bisetata, Guen. Phal. i. p. 462 (1857).
Eois bisetata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 87.

Several specimens from Oiwake and Yokohama in Pryer's collection. I obtained the species at Ningpo in April, at Nagasaki in May, and my native collector at Gensan in July.

Specimens were received from Chang-yang and Moupin, taken in July.

Distribution. Europe; E. Siberia; Amur; Kiushiu, Corea; Central, Western, and North-eastern China.

Acidalia auricruda.

Asthena auricruda, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 438 (1879).

A series in Pryer's collection from Nikko and Yesso.

My native collector obtained examples at Gensan in July.

Hab. Japan, Yesso, and Corea.

Acidalia invalida.

Acidalia invalida, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 439 (1879).

Specimens from Oiwake in Pryer's collection.

I took the species at Fusan in June, and I have received it from Chang-yang.

Distribution. Japan; Corea; Central China.

Genus CHRYSOCRASPEDA.

(Hampson, Fauna Brit. Ind., Moths, iii. p. 443 (1895).)

Chrysocraspeda proximaria, sp. n.

Pale buff. Primaries have a black discal dot, with a dusky

cloud below it and a blackish, dotted, curved, and recurved line beyond the middle; the costa is edged with purplish brown. Secondaries have a black discal dot and a curved series of blackish dots beyond the middle. Fringes darker brown, preceded by a rather broad purplish-brown line. Under surface slightly paler than above; transverse lines more distinct; line before fringes narrower and paler.

Expanse 25 millim.

Two male specimens from Moupin, July.

Hab. Western China.

Allied to *C.* (*Hyria*) *marginata*, Swinh., but larger, and the primaries are more pointed.

Genus Ninodes.

(Warren, Novit. Zool. i. p. 465 (1894).)

Ninodes splendens.

Ephyra splendens, Butl. Ill. Typ. Lep. Het. ii. p. 51, pl. xxxvii. fig. 1 (1878).

Ninodes splendens, Warren, Novit. Zool. i. p. 465 (1894).

A very fine series from Oiwake and Yokohama in Pryer's collection. I obtained the species at Nagasaki in May, and have received it from Ichang and Ta-chien-lu.

Distribution. Japan; Kiushiu; Central and Western China.

Genus Ephyra.

(Dup.; Hampson, Fauna Brit. Ind., Moths, iii. p. 445 (1895).)

Ephyra brunnearia, sp. n.

Pale brown, with a slight vinous tinge on the outer marginal area of all the wings. Primaries have a subbasal line indicated by black dots on the nervures; a dusky curved and recurved central band and a wavy submarginal line, also dusky and dotted with black on the neuration; discal spot brownish. Secondaries have a white discal spot encircled with black and seated on a dusky transverse band; submarginal line as on primaries. Fringes concolorous with the wings and finely dotted with black at ends of the nervules. Under surface similar to above, but the discal spot of primaries has a pale centre and that of the secondaries is less distinct.

Expanse 34–36 millim.

Five male specimens and one female from Chow-pin-sa, Wa-ssu-kow, Ni-tou, Kia-ting-fu: June.

Hab. Western China.

Genus Tanaotrichia.

(Warren, Proc. Zool. Soc. Lond. 1893, p. 361.)

Tanaotrichia trilineata.

Tanaotrichia trilineata, Warr. Proc. Zool. Soc. Lond. 1893, p. 361, pl. xxxii. fig. 2.

One male specimen from Che-tou, taken in July or August.

Distribution. Western China; Sikhim.

Hampson considers this to be a form of *Erythrolophus prasonarius*, Swinh. (Fauna Brit. Ind., Moths, iii. p. 455).

Genus Rhodostrophia.

(Hübn.; Hampson, Fauna Brit. Ind., Moths, iii. p. 455 (1895).)

Rhodostrophia pelloniaria.

Phyletis pelloniaria, Guen. Phal. ii. p. 169 (1857).
Rhodostrophia pelloniaria, Hampson, Fauna Brit. Ind., Moths, iii. p. 456 (1895).

Several specimens from Pu-tsu-fong and Chow-pin-sa, taken in June.

Distribution. Murree; Thundiáni; Khásis (*Hampson*); Western China.

Rhodostrophia vinacearia.

Anisodes (?) *vinacearia*, Moore, Proc. Zool. Soc. Lond. 1867, p. 642.
Rhodostrophia stigmatica, Butl. Ill. Typ. Lep. Het. vii. p. 110, pl. cxxxvi. figs. 19, 20 (1889).
Rhodostrophia vinacearia, Hampson, Fauna Brit. Ind., Moths, iii. p. 455 (1895).

Several specimens received from Chang-yang and Moupin.

Distribution. Murree; Dharmsála; Sikhim; Khásis (*Hampson*); Central and Western China.

Rhodostrophia philolaches.

Gnophos philolaches, Oberth. Etud. d'Entom. xv. p. 22, pl. iii. fig. 26 (1891).
Eusarca tibetaria, Staud. Iris, viii. p. 231 (1895).

A long series, comprising both sexes, from Ta-chien-lu, one example from Moupin, and one from Ni-tou: June and July.

Hab. Western China and Thibet.

Rhodostrophia (?) *sinuosaria*, sp. n.

Whity brown. Primaries have a thin, curved, blackish subbasal line, spotted with black below costa and on the

median and submedian nervures; a triangular black discal spot and a sinuous black line, dotted with black on the venation, beyond; submarginal line pale, wavy, but not clearly defined. Secondaries have a black discal dot and a dotted sinuous line beyond; this line is bordered outwardly with fuscous, as also is the corresponding line on primaries. Fringes of the ground-colour preceded by a series of black dots. Under surface whity brown: primaries suffused with fuscous from base to just beyond the linear discal spot; transverse lines on all the wings as above, but fainter, especially on primaries.

Expanse 42 millim.

Two male specimens from Pu-tsu-fong: June.

Hab. Western China.

Genus Timandra.

(Dup.; Hampson, Fauna Brit. Ind., Moths, iii. p. 458 (1895).)

Timandra amataria.

Geometra amata, Linn. Syst. Nat. x. p. 524 (1758).
Calothysanis amataria, Hübn. Verz. Schmett. p. 311; Meyrick, Trans. Ent. Soc. Lond. 1892, p. 91.
Timandra amataria, Dup. Lép. vii. pl. cxlviii. fig. 3; Hampson, Fauna Brit. Ind., Moths, iii. p. 458 (1895).
Timandra comptaria, Walk. Cat. Lep. Het. xxvi. p. 1615; Butl. Ill. Typ. Lep. Het. iii. pl. li. fig. 2 (1879).

Very variable and generally distributed throughout Japan. The species was also met with by my collectors in most of the localities that they visited in Central and Western China.

Distribution. Europe and Eastern Asia.

Timandra extremaria.

Timandra extremaria, Walk. Cat. Lep. Het. xxiii. p. 811 (1861); Butl. Ill. Typ. Lep. Het. iii. pl. li. fig. 1 (1879).

This species appears to be generally distributed in Central and Western China. It also occurs at Ningpo.

The specimens in my series range in expanse from 34 millim. to 44 millim. and exhibit a good deal of variation in the width of the oblique line.

Hab. China.

Genus Problepsis.

(Led.; Hampson, Fauna Brit. Ind., Moths, iii. p. 461 (1895).)

Problepsis delphiaria.

Argyris delphiaria, Guen. Phal. ii. p. 14 (1857).
Problepsis delphiaria, Hampson, Fauna Brit. Ind., Moths, iii. p. 462 (1895).

One example from Moupin, Western China: July.

Distribution. Hong Kong; throughout India, Ceylon, and Burma (*Hampson*); Western China.

Problepsis deliaria.

Argyris deliaria, Guen. Phal. ii. p. 13 (1857).
Problepsis deliaria, Hampson, Fauna Brit. Ind., Moths, iii. p. 462 (1895).

I took a male specimen in May in Satsuma and have received other specimens of the species from Chang-yang and Kiukiang, Chia-ting-fu, the province of Kwei-chow, and also from Ningpo.

Distribution. Throughout India, Ceylon, and Burma (*Hampson*); China and Kiushiu.

Problepsis superans.

Argyris superans, Butl. Cist. Ent. iii. p. 122 (1885).
Problepsis discophora, Fixsen, Rom. sur Lép. iii. p. 348, pl. xv. fig. 4 (1887).

There was a female specimen from Yesso in Pryer's collection. I took a female at Gensan in July, and have received specimens from Kia-ting-fu, Omei-shan, and Chang-yang.

Independent of other differences, this species may be at once separated from *P. deliaria*, Guen., by the space between the antennæ being white. In expanse it ranges from 40 to 60 millim.

Distribution. Japan; Corea; Western and Central China.

Genus Dithalama.

(Meyrick, Proc. Linn. Soc. N. S. W. (2) ii. p. 840 (1887); Trans. Ent. Soc. Lond. 1892, p. 90.)

Dithalama indicataria.

Argyris indicataria, Walk. Cat. Lep. Het. xxiii. p. 809 (1861); Butl. Ill. Typ. Lep. Het. iii. p. 43, pl. li. fig. 8 (1879).
Dithalama indicataria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 91.

This species seems to occur throughout Japan from May to July. I also met with it at Gensan in June.

I have received it from Ichang and Chang-yang, and Walker records it from North China.

Distribution. Amur; Corea; Japan; Kiushiu; Central and Northern China.

[To be continued.]

Errata (Ann. & Mag. Nat. Hist. ser. 6, vol. xix.).

Pp. 188, 189, for *Oberthüria* (nom. præoc.) read *Parabraxas*.
P. 546, *for* Genus *Emmecosmia read* Genus *Emmesomia*, and for *Emmecosmia bilinearia*, sp. n., read *Emmesomia parallelaria*, sp. n.

IX.—*On new Species of Rhopalocera from Toungoo, Burma, and the Battak Mountains in Sumatra.* By Major J. M. Fawcett.

Ragadia simplex, sp. n.

Hab. Battak Mountains, Sumatra: June 1896.

Description.—Male. Upperside pale fuliginous brown, crossed by two darker fuscous bands running parallel to one another from the costa of the fore wing to the inner margin of the hind wing, the outer being much broadened on the hind wing. There is also a shorter band proximal to the body, which, starting parallel to the others on the fore wing costa, ends at the origin of the submedian of the fore wing.

From the apex of the fore wing to the inner angle of the hind wing runs a submarginal row of small indistinct fuscous spots, one in each interspace. The wing-margins are narrowly fuscous, the colour being bounded by a narrow submarginal band looped on the fore wing and on the hind wing parallel to the margin.

Underside similar in markings to the upper, but the ground-colour pale buff and the row of spots silver instead of fuscous.

The antennæ, head, thorax, abdomen, and legs like those of *R. crisia*, Hübner, from which this species differs in its generally pale ground-colour, and in the ocellate band of *crisia* being reduced to mere pupils of silver below and fuscous above.

Cynthia circe, sp. n.

Hab. Toungoo, Burma (March to June); Beeling, Tenasserim.

Description.—The species is allied to *C. erota*, Fabr., and *pura*, Swinhoe, from Cherra Punji. The male has exactly the colour of that sex of *pura*, Swinhoe, and only differs in the greater irregularity of the dark line crossing the wings from the middle of the costa of the fore wings to the anal angle of the hind wings and in the slightly more produced tail at the third median vein of the hind wings. The dark wing-markings tend to be a little more distinct.

Female. Upperside differs from that sex of *C. erota* in the white band of both wings being much broader, extending decreasingly in breadth to the anal angle of the hind wing, and the submarginal area beyond the white band being golden

brown instead of bluish fuscous. Underside no purple suffusion.

A character common to both sexes is the almost complete absence of the discal zigzag fuscous fascia which crosses the middle of both wings in typical *C. erota*, the white band in the female and the lighter band in the male of *Cynthia circe* being almost immaculate. I have a series of males from Burma which present absolutely no variation in the characters described above, and I possess but one female from Toungoo, Burma, which is exactly matched by a female in the British Museum from Beeling, Tenasserim. If the *C. asela* of Moore, from Ceylon, is recognized as a species distinct from *C. erota* (Fabricius), this species must also be regarded as distinct, as the Ceylon form is much nearer *C. erota* (typical) in both sexes.

Charaxes ajax, sp. n.

Hab. Battak Mountains, Sumatra: June, July.

Description.—Male. Allied to *C. corax*, Felder, from which it differs in the ground-colour of upper and underside being darker, the outer black band on the upperside of the fore wing being slightly broader and extending broadly black to the anal angle of the fore wing, its inner edge straighter, as the crescentic markings are clearly detached in the intermedian spaces; two fulvous spots, the upper displaced outwards between the radial, and the lower in the following interspace, continuing the series of fulvous lunules formed by the black crescents and the border.

The submarginal black spots on the hind wing are larger and more triangular, their inner edges irrorated with black atoms, and the first four from the anal angle tipped with a minute white spot. The underside is of a rich glaucous colour, in some lights inclining to purplish, much darker than any *corax*, more resembling some of the darker specimens of *baya*, Moore. The light violaceous antemarginal line is present in the fore wing, and within it are indistinct greenish lunules. In the hind wing a broad antemarginal band of olivaceous green, sinuated in each interspace, is bounded anteriorly by a narrow brownish border.

The disk is crossed by the usual dark lines, the outermost bounded by olivaceous green irrorations, which are wanting in *corax*.

Poritia geta, sp. n.

Hab. Toungoo, Burma: March.

Description.—Male. Allied to *P. pleurata*, Hew., and

P. Hewitsoni, Moore. The blue area as large as in the former, occupying the entire discoidal cell of the fore wing, and in the submedian interspace all but reaching the outer margin. There are two blue apical spots as in *Hewitsoni*, but no black spot in the submedian interspace as in most specimens of that species, nor even the black line on the submedian vein as in typical *pleurata*. In the hind wing the blue area occupies the discoidal cell and extends a little above the radial. The outer margin of the hind wing is narrowly black, and there are, as in *pleurata*, traces of marginal and submarginal rows of black markings.

Below, the markings much resemble those of *pleurata*, but are more indistinct, more parallel, and on a pale ground.

X.—*Description of a new Rat from China.*

By Oldfield Thomas.

Among a collection made at Kuatun, N.W. Fokien, and presented to the National Museum by Messrs. J. de La Touche and C. B. Rickett, there occur three specimens of a fine large rat as large as *Mus Edwardsi*, Thos., found at the same locality, but quite different from that and more nearly allied to the Burmese *Mus Bowersi*, And. It is, however, clearly distinct, and may be called

Mus Latouchei, sp. n.

Size very large. Upper surface uniformly clear grizzled grey, without tinge of yellow; the fur composed of grey hairs intermixed with slender, flattened, white, brown-tipped spines, not numerous or stiff enough to make the fur feel really spinous. Under surface pure white or yellowish white throughout, the line of demarcation on sides not very sharply defined. Ears large, evenly rounded. Hands white above, the fingers almost naked. Feet greyish proximally, white on the digits. Tail about as long as the head and body, its scales averaging about ten to the centimetre, very thinly haired, uniformly brown above and below, the extreme tip white.

Skull, in proportion to the size of the animal, rather lightly built. Compared to that of *Mus Bowersi* the nasals are more square-ended behind, the line of the fronto-premaxillary and fronto-nasal sutures runs straight across from side to side

instead of being bowed backwards; the supraorbital rims are more developed (though still small for so large an animal), and are continued along the parietals to the outer corners of the intermaxillary. Anterior edge of anteorbital plate more slanting. Posterior nares wider and more open than in the allied form. Incisors broad, pale yellowish, finely but irregularly striated in front.

Dimensions of the type (an adult female in skin) :—

Head and body (probably stretched) 310 millim.; tail 290; hind foot (moistened) 60 *.

Skull: basal length 51·3; greatest breadth 27·4; nasals 23 × 5·6; interorbital breadth 8·2; breadth of brain-case 21·3; interparietal 7 × 16·2; palate length from henselion 26; diastema 17; anterior palatine foramina 10·6 × 4; length of upper molar series 9·1.

Hab. Kuatun, N.W. Fokien.

Type: B.M. no. 97.6.6.2.

This fine rat is evidently very closely allied to *Mus Bowersi*, which is a native of Burma and Tenasserim, and is therefore widely distinct from it geographically. It differs, however, by its rather larger size, especially its longer hind feet, and by the various cranial differences above enumerated.

It is named in honour of Mr. J. de La Touche, of Foochow, to whom, in conjunction with Mr. Rickett, the British Museum is indebted for a considerable number of valuable Chinese mammals. Among these may be specially mentioned examples of the rare *Typhlomys cinereus*, M.-Edw., specimens which have enabled me for the first time to show the proper position of this interesting genus †.

BIBLIOGRAPHICAL NOTICE.

Ueber die Palpen der Rhopaloceren. Ein Beitrag zur Erkenntnis der Verwandschaftlichen Beziehungen unter den Tagfaltern. Von Enzio Reuter. (Acta Societatis Scientiarum Fennicæ, tom. xxii. No. 1.) (Helsingfors, 1896.)

The early writers on insects used to complain that the Order Lepidoptera was one of the most difficult of all to classify, on account of the deficiency of characters. But with the increase of our know-

* The two other specimens have hind feet 57·5 and 58 millim. long. Three spirit-specimens of *M. Bowersi* in the Fea collection have feet respectively 51, 51, and 52 millim. in length.

† P. Z. S. 1896, p. 1016.

ledge we find that characters abound, and it is now rather a question of the real value to be attached to the structure of different organs than a matter of complaint that characters cannot be found. Nor shall we arrive at a really satisfactory system of classification of Lepidoptera until the structure of the principal organs has been worked out in all the various stages of the insects; and this is a lifelong study for a great number of observers.

The author of the present treatise has directed his attention chiefly to the structure of the palpi in butterflies, paying special attention (1) to the outward structure and form, (2) to the hairy or scaly clothing of the palpi, and (3) to the basal spot, which is a bare space on the inner side of the basal joint, which is striated, pitted, and set with numerous conical hair-scales. For the purposes of the present work 3557 palpi have been examined, belonging to 670 species and 302 genera, the result of this long and patient study being embodied in the elaborate treatise before us. It is illustrated by 6 plates, the first five representing structural details and the sixth containing a genealogical tree of the evolution of the Lepidoptera. The *Hesperiidæ* are regarded as a distinct suborder from the Rhopalocera, under the name of Grypocera, which is certainly an improvement on the more usual course of treating them as an aberrant family of the latter.

The first portion of the work consists of a description of the general form and clothing of the palpi under the various genera, and especially of the basal spot; the description of the latter sometimes exceeds in length that of all other structures noticed. Having concluded this, the author generalizes his results, and discusses the comparative relations of the various families and smaller subdivisions which he admits. Here his observations are not confined to the palpi, but extend to the neuration and other morphological characters of the insects; and he shows himself to be thoroughly acquainted with the extensive and not always easily accessible literature of the Order Lepidoptera, and compares his own conclusions with those of other writers to great advantage.

This is followed by general observations on the origin and classification of the Lepidoptera, not without reference to palæontological considerations; and by an extensive Bibliography, filling 11 closely printed pages.

We congratulate the author on the completion of a valuable and meritorious work, which marks an epoch in the study of the particular structures to which it is devoted. Much good work has previously been accomplished in Finland in other orders of insects; and the Finns are fully entitled to claim as high a rank as entomologists as they have long occupied as philologists.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

March 24, 1897.—Dr. Henry Hicks, F.R.S., President, in the Chair.

The following communications were read :—

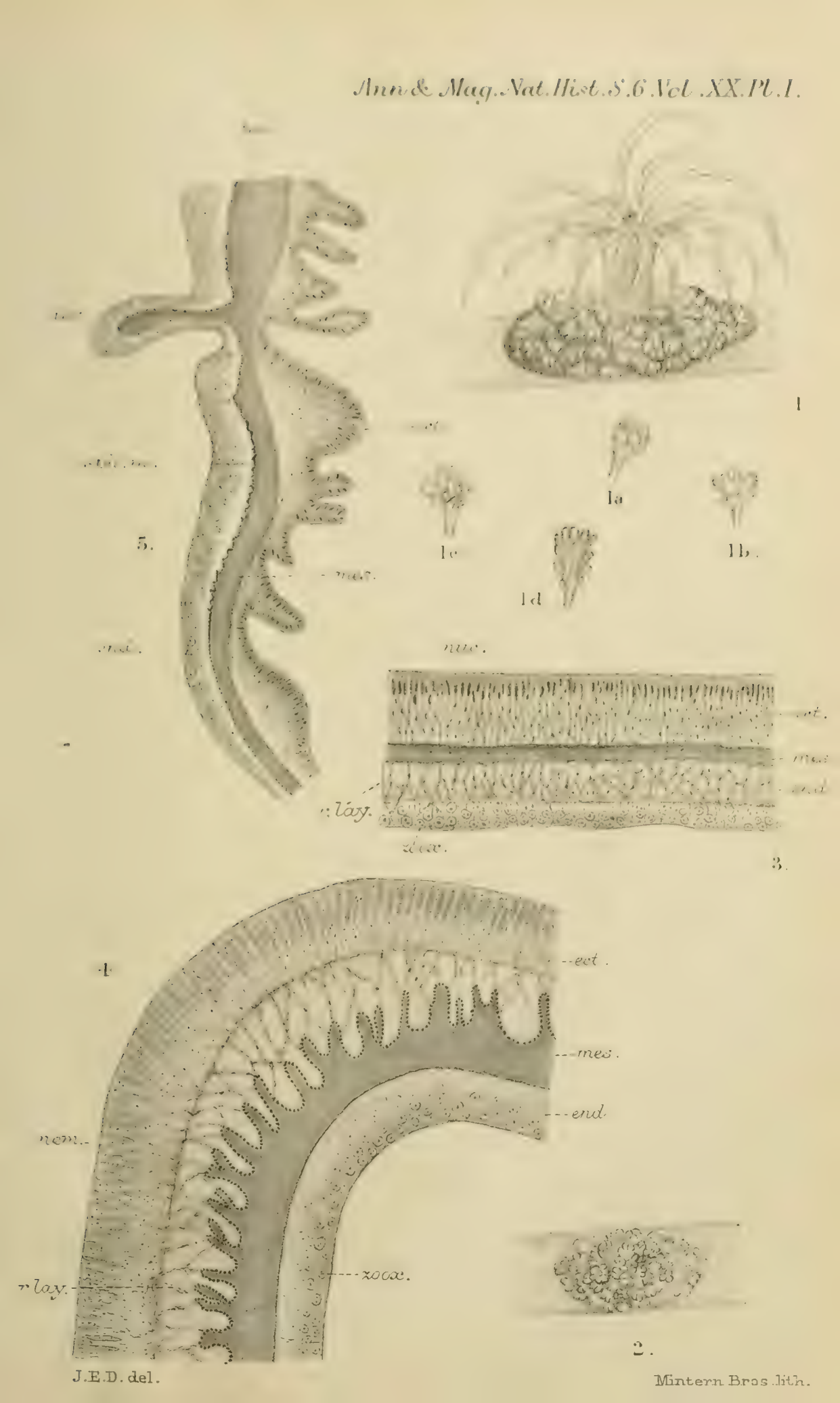
1. 'On the Association of *Sigillaria* and *Glossopteris* in South Africa.' By A. C. Seward, Esq., M.A., F.G.S., University Lecturer in Botany, Cambridge.

In this paper the Author describes in detail several specimens of fossil plants submitted to him by Mr. David Draper of Johannesburg. His conclusions as to the geological age of the plant-bearing beds differ from those arrived at by Mr. Draper from stratigraphical evidence ; the plants point to an horizon which may be referred to what is now termed the Permo-Carboniferous age. The difficulty of distinguishing between various forms of *Glossopteris*-leaves is discussed at some length ; and the opinion expressed that it is practically impossible to separate the Indian, Australian, and African forms of *G. Browniana*, *G. indica*, and others. The chief interest as regards the plants centres round the specimens of *Sigillaria* ; these are fairly well preserved impressions, and are referred to the well-known species, *S. Brardi*. In addition to various forms of the genus *Glossopteris* and the specimens of *Sigillaria*, the following plants are recorded :—*Noeggerathiopsis Hislopi*, *Gangamopteris cyclopteroides*, *Phyllotheca*, *Conites* sp., *Cardiocarpus* sp., and *Sphenopteris* sp.

The paper concludes with some general remarks on botanical provinces in the Northern and Southern Hemispheres, and the relation of the *Glossopteris*-flora to the Coal-Measure vegetation of Europe.

2. 'Notes on the Occurrence of *Sigillaria*, *Glossopteris*, and other Plant-remains in the Triassic Rocks of South Africa.' By David Draper, Esq., F.G.S.

The Author gives a brief description of the geology of four localities, within a comparatively short distance from Johannesburg, from which several fossil plants have recently been obtained. He considers the plant-bearing beds to belong to the Lower Stormberg Series of Dunn, and to the horizon known as the Molteno Beds. The most important locality described in these notes is that of Vereeniging, 30 miles south of Johannesburg, where the Author found several specimens of *Sigillaria* associated with *Glossopteris* and other plants in iron-stained sandstones. The significance of this discovery of *Sigillaria* is briefly discussed. The several species of plants have been described by Mr. A. C. Seward in a paper recently sent to the Society.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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 116. AUGUST 1897.

XI.—*Notes, Morphological and Systematic, on the Madreporarian Subfamily* Montiporinæ (Montipora *and* Anacropora), *with an Account of the Phylogeny of the* Madreporidæ. By H. M. Bernard, M.A. Cantab.

[Plate II.]

In continuation of the work of cataloguing the National Collection of Corals, I have devoted nearly two years to the study of the genus *Montipora*. I propose in this paper to give a short summary of the morphological results arrived at. Before doing so, however, I should like to take this opportunity of expressing my gratitude to the Director, Sir William Flower, F.R.S., for the friendly interest he has taken in the progress of the work, and also to my friend Prof. F. Jeffrey Bell, who has charge of the coral collection, not only for valuable advice and criticism, but also for much active and willing help.

The first volume of the official catalogue dealt with the genus *Madrepora*, and was written by the late George Brook; the second volume, containing two smaller genera—*Turbinaria* and *Astræopora*—is the work of the present writer. The morphological results arrived at during the preparation of that volume will be found in its introductory chapters and in two papers in this Magazine *. The present study of the Montiporinæ, which, with *Madrepora*, *Turbinaria*, and

* Vol. xv. 1895, p. 499, and vol. xvi. p. 273.

Astræopora, form the family Madreporidæ, enables me to summarize the conclusions arrived at as to the inter-relationships of these genera. That summary will constitute the concluding part of this paper.

The Genus Montipora.

This genus differs in many remarkable points from either *Madrepora*, *Turbinaria*, or *Astræopora*, and doubts as to its affinities are, as we shall see, very prominent in the works of former students. Though founded by Quoy and Gaimard, the name appeared first in print in de Blainville's 'Dictionnaire des Sciences naturelles,' t. lx. (1830), the author having seen it in MS. He placed the new genus between *Gemmipora* (= *Turbinaria*) and *Madrepora* and among a number of other genera, including *Porites*.

In 1834 Ehrenberg* suppressed the genus, distributing the species among the *Porites*. Dana, in 1848, re-established and greatly enlarged the genus, but changed its name to *Manopora*. He objected that the word *Montipora* referred to the cœnenchymatous elevations of the surface, which were not universally present. He thought that the genus *Manopora* was closely allied to *Madrepora*, and, in fact, could be deduced from it by the degeneration of the protuberant calicles.

In 1849 Milne-Edwards and Haime removed it from the Madreporidæ and placed it among the Poritidæ, and to this arrangement they kept in their monograph of the Poritidæ in 1851†; they there noted, however, that *Montipora* showed certain structural resemblances ("quelques rapports de forme") with the Madrepores.

Prof. Verrill at first adopted Milne-Edwards's arrangement, but eventually followed Dana in placing the genus among the Madreporidæ.

Brüggemann apparently came to no conclusion. In two papers which appeared after his death the genus is variously placed. In one the Montiporidæ followed the Madreporidæ and Poritidæ; in the other *Montipora* occurs with *Porites*, *Turbinaria*, &c. under the Madreporidæ.

Prof. Studer, in 1878, followed Milne-Edwards, but in 1880 adopted Dana's classification so far as to class *Montipora* with *Madrepora*. Klunzinger also follows Dana in this respect.

* 'Corallenthiere des rothen Meeres.'

† Ann. d. Sci. Nat. ser. 3, xvi. p. 21.

In 1884 Ridley* denied the close relationship between *Montipora* and *Madrepora* claimed by Dana. The forms of the latter which, owing to the obscuration of the apical polyp, Dana thought might constitute a connecting-link between the two, lent, according to Ridley, no support to such a conclusion, inasmuch as the apical polyps in these types are not really absent, but only inconspicuous owing to their multiplication. Further, it was claimed that a far-reaching difference in the method of budding separated the two. In *Madrepora* the budding is said to be centrifugal, the fresh buds forming below the central apical polyp, while in *Montipora* undifferentiated cœnenchyma takes the lead and the fresh polyps appear above one another. I shall endeavour to estimate later on to what extent this is a true diagnosis of *the* morphological difference between *Madrepora* and *Montipora*.

Duncan, in 1884 †, in his revision of the Milne-Edwards and Haime system, followed these authors in placing *Montipora* with *Porites*.

Quelch, in 1886, in his description of the 'Challenger' Reef Corals, placed *Montipora* among Madreporidæ, as does Miss Ogilvie in her recent "Microscopic and Systematic Study of Madreporarian Types of Corals" ‡.

Lastly, in 1889 Dr. Ortmann §, after following Dana in 1888, classed the Montiporidæ with the Madreporidæ, Poritidæ, Turbinariidæ, &c. as independent families of the Madreporacea.

The conclusion here arrived at on this point, viz. that the *Montipora* belong unmistakably to the Madreporidæ, is based upon a study and comparison of nearly 400 specimens, divisible into some 120 types, of which more than half are new.

The youngest colony that I found is contained in a small oval epithecal saucer, 3·5 millim. long diameter (Pl. II. figs. 1, 2). This saucer is filled with a spongy cœnenchyma. One polyp, about ·25 millim. in diameter, opens in the highest part of the cœnenchyma and near the centre, while a few smaller ones open between it and the epitheca. It seems to me that there is no escape from the conclusion that this largest and most central polyp is the parent polyp of the colony, and that the cœnenchyma stretching from it to the epitheca in which the other polyps open is, or more correctly *was*, before the other polyps appeared, its thick porous wall.

* Ann. & Mag. Nat. Hist. (5) xiii. p. 284.
† Journ. Linn. Soc. vol. xviii.
‡ Phil. Trans. vol. clxxxvii. (1896).
§ Zool. Jahrb. vols. iii. and iv. (syst.).

It will, perhaps, be remembered that I found just such a young colony of *Astræopora*, and, further, I concluded that the morphological differences between *Turbinaria* and *Madrepora* could be best explained by postulating such a young colony in each case; in *Madrepora* the central polyp grew up with tiers of daughters springing from its side, while in *Turbinaria* the ring of daughters shot ahead and formed a cup.

We are then, I think, justified in deducing *Montipora* from a parent polyp opening in a mass of spongy cœnenchyma, *i. e.* with a very thick porous wall, contained in a saucer-like epitheca. In *Montipora*, unlike the Madreporidæ just mentioned, the parent polyp formed no projecting cone, but opened level with the upper flattened surface of its thick wall. Similarly the young polyps, opening laterally, do not form protuberant cones; they appear as mere openings in the cœnenchyma, often in contact with the epitheca, in which case the latter may form part of their outer walls.

The cœnenchyma in the young specimen actually examined consists, as seen from the surface, of jagged flakes, which may be twisted in all directions, but which tend to lie horizontally; the apertures of the polyp-cavities are bounded by the edges of two or more such flakes: in this particular instance the cœnenchyma has been secondarily specialized. From the edges of the flakes points project into the polyp-cavity and form vertical series of spines. These series of spines are, in many types, the only remains of the septal apparatus. Examination of all the types, however, shows that the septa were originally lamellate, as in the other Madreporidæ. The large directives are often continuously laminate, and here and there some of the other primaries also; while, again, what appear to be traces of laminate costæ can be found in the cœnenchyma of very many types. To these important points, as also to the cause of the widespread degeneration of the septal apparatus, we shall return.

Starting, then, from such a young colony, with its parent polyp surrounded by a ring of daughters all immersed in a mass of spongy reticulum contained in an epithecal saucer, the stock may develop along different lines. But while in the other Madreporidæ the *calicles lead and the cœnenchyma fills up the interstices*, in *Montipora* the *cœnenchyma takes the lead* in the formation of the corallum. I am aware that these expressions may, at first sight, appear very loose; they are, however, sufficiently useful to render their employment justifiable, provided we are quite clear as to what they really mean. We must clearly recognize that the

term cœnenchyma applies, in the Madreporidæ, to the fused porous walls of the individual polyps forming the colony. In using the expressions "the calicles lead" and "the cœnenchyma fills up the interstices," what is really meant is that the walls of the individual polyps are distinguishable as such above the level of fusion; where the walls fuse together to form the cœnenchyma they cease to be distinguishable. While, then, in the other Madreporidæ the walls of individual polyps are typically recognizable in so far as they keep above the level of their fusion, in the genus *Montipora* as soon as the parent polyp has budded to form a colony, no matter how small, we can no longer speak of any porous walls except theoretically, for, fusing right up to the level of their apertures, they together form an expanding mass of cœnenchyma. It was this last-mentioned fact that struck Ridley as presenting such a contrast to the method of growth in *Madrepora*; but the true explanation of the difference is not to be found in his "centrifugal" and "centripetal" methods of budding, for it is obvious that any generalization affecting a genus which leaves all the more primitive explanate growths out of the reckoning must be unreliable. The true significance of these comparisons will be still further discussed in the section on the affinities of the genus, as will also the fact that the cœnenchymatous edge of the rim of the cup in *Turbinaria* is closely comparable with the cœnenchymatous edge of a foliate Montipore.

In view, then, of this great development of the cœnenchyma and of its prime importance in building up the Montiporan coralla, we have, it seems, no choice but to utilize the variations presented by the cœnenchyma as the basis of our classification. In so doing we emphasize the fact that the *Montiporæ* are cœnenchymatous corals *par excellence*, that, whereas the cœnenchyma of the Madreporidæ is primarily merely the tissue arising by the more or less limited fusion of the porous walls of adjoining polyps to form a mutual support, in *Montipora* it is more than this. Resulting from the complete fusion of the walls, it has in many cases taken on other functions as well as that of a supporting and cementing tissue, for, rising above the level of the polyp-cavities, it is specialized in various ways for their protection.

A study of the variations which the cœnenchyma presents supports this assumption of its taxonomic importance. The specimens admit of being divided in the most natural way according to the specialization of the cœnenchyma. We also have the additional satisfaction of finding that transition forms reveal the lines along which the leading specializations

have travelled. Hence, although one would never have selected a tissue like the cœnenchyma, which all experience shows to be dangerously variable, as a basis for classification, there is in the present case really no choice, *i. e.* if our morphological diagnosis is correct. Hitherto the variations of the surface cœnenchyma—very superficially handled—have been accorded only a secondary place. Dana, deducing *Montipora* (*Manopora*) from *Madrepora* by the degeneration of the calicles, classified its species accordingly into those in which the protuberant calicles persisted and those in which they had quite disappeared, the latter group being further subdivided according to the form of the corallum and the character of the surface. Milne-Edwards and Haime divided the *Montipora* primarily according to the form of the corallum. We may at once dismiss this latter classification as purely artificial. Returning, however, to Dana, it must be noted that there is no evidence whatever to make us believe that *Montipora* is deducible from *Madrepora* by gradual degeneration of protuberant calicles. The only Montiporan forms which Dana adduced as transitional hardly support his contention: one—*M. gemmulata*—has been removed by Verrill to the Turbinarians, while the protuberant calicles in the other—*M. caliculata*—are not true calicles in Dana's sense, but a peculiar specialization of the interstitial cœnenchyma which will be referred to again.

We have, then, no choice but to accept the variations in that tissue, the specializations of which are essentially the peculiarity of the genus, as the basis of classification. Beneath all its baffling superficial variations the laws of its growth can be made out and the main lines along which it has diverged can be traced. This serves to divide the genus into groups which have some claim to be natural. Uncertainty, however, comes in when, in further subdividing these groups, we come within range of the superficial variability due to accidents of position and nutrition. It must therefore be at once confessed that many of the assumed specific variations are not to be relied upon. The "species" established are in many cases only descriptions of individual specimens the surface characters of which give no clue as to their affinities with other specimens. Of course in many cases there are other characters sufficiently striking to justify us in confidently claiming new and distinct types.

The following analysis of the development of the cœnenchyma was only very gradually arrived at after studying series of sections revealed by fractured specimens. It will be best understood if we reverse the process of its discovery,

and, assuming our conclusions to be correct, start from the hypothetical parent-polyp of the genus.

This polyp, as we have seen, differed from that of *Madrepora*, *Turbinaria*, and *Astræopora* in that the porous theca did not rise up into a cone, but was low and thick, filling up, but probably not much overtopping, the rim of the epithecal saucer. Primarily the porous walls consisted of radial laminæ joined together by synapticulæ*, so that the cœnenchyma surrounding this parent polyp may be said to radiate outwards towards the edge of the epitheca. When the first ring of buds appeared just within the edge of the epitheca their walls would also radiate outwards, either continuing to be supported by an extension of the primitive epitheca or shooting out freely beyond its edge. From this initial stage in the development of *Montipora* we should expect to find the cœnenchyma consisting of laminate plates standing at right angles to the epitheca and radiating outwards on all sides. We should expect to find this because the cœnenchyma is nothing but the resultant of fusion of the porous walls of the component polyps, and their laminate costæ would necessarily be arranged in the manner described.

Now this initial stage in the growth of the Montiporan corallum is traceable in almost every type. A surface of fracture through any explanate Montiporan will almost invariably reveal a thin basal layer streaming outwards towards the growing edge. While this basal "streaming layer" is of fairly uniform thickness and the direction of its fibres is always outwards—*i. e.* in the line of growth—its texture may vary. (1) It may be composed of ribbon-like bands running outwards more or less at right angles to the epitheca, but so united as to form a system of flat canals apparently freely communicating with one another. This laminate reticulum, occurring as it invariably does in the "streaming layer," may, I think, safely be regarded as a vestige of the primitive laminate costæ which were once the most important element in the calicle walls. (2) The primitive band-reticulum may, owing to the extensive perforation of the laminæ, have lost this character and have become a filamentous reticulum. In this case also the direction of the threads is typically very pronounced, streaming outwards towards the growing edge. There are, lastly, a few cases in which the reticulum shows no special streaming; these would appear to have been secondarily modified. Here it should be remarked that only

* I use this term generally for all outgrowths from the faces of septa for their mutual support, irrespective of their form and position.

fractures in the direction of growth at any time show the appearance here called streaming; all sections across the streaming show what might be called, in contradistinction, a "stationary" reticulum.

In the figures 3 and 4 *d* (Pl. II.) the artist—Mr. Percy Highly—has well shown by dots the usual appearance of the streaming layer. If these dots are thought of as pores in radial (septo-costal) plates lying in the plane of the paper, the reader will get a fair idea of what I believe to have been the origin of the streaming layer. The relative thickness of the streaming and of the thickening layer in figs. 3 *a*, 3 *b*, 3 *c* should be reversed. The thinness of the streaming layer is probably indicative of the very early budding of the polyps.

We have, then, in all Montiporans (with a few secondary modifications) a basal layer of reticulum streaming outwards (no matter how large or small the colony may be) and forming the growing edge, with or without the supporting epitheca. This streaming layer, which expands the corallum, for some reason or other cannot, as such, thicken it, and the new formation of cœnenchyma for this purpose is in most cases sharply marked off from the streaming layer. An explanation of this thickening layer, shown in figures 3 *a*, 3 *b*, 3 *c*, as compared with 4 *d*, will be suggested later on.

The thickening layer, wherever the epitheca accompanies the growing edge, is confined to the upper surface; but if the growing edge is free, thickening layers may be added to both upper and under surfaces. These layers are derived from the threads or jagged edges of the surfaces of the streaming layer. On the upper surface they grow upwards at right angles to the direction of the streaming, and, uniting among themselves, form a filamentous reticulum. Similarly a layer of reticulum developed from points of the streaming layer bent down at right angles to that layer may cover the under surface. Whereas the upper layer may develop to almost any thickness and give rise to a very great variety of beautiful surfaces, the lower layer seldom thickens much; the individual threads soon tend to thicken, and thus to form a very dense reticulum, and sooner or later the epitheca grows out, covering over the calicles and leading to the more or less complete solidification of the lower surface.

This description of the thickening and solidification of the lower surface does not apply to erect leaves or to branches which may be regarded as thick rounded leaves. In these cases the thickening layer may develop evenly on both sides of the leaf or all round the branches, and show all the surface specializations which in the horizontally growing specimens

are confined to the upper surface. In the case of the branched specimens the tips of the branches which correspond with the growing edge of the explanate forms consist entirely of the streaming layer, and this may be seen forming the axis of all the stems. The cortical layer, which gradually thickens the branches, can in most cases be seen to be formed of threads bending outwards at right angles to the direction of the axial streaming layer.

Leaving, then, the primitive basal streaming layer, we have to consider the variations presented by the upper thickening layer just described :—

(1) It may merely thicken the streaming layer gradually as a filamentous reticulum, the surface in which the calicles open remaining all the time smooth. In reference to the level surface, I have called this group "glabrous," and under it I have arranged some thirty different types (fig. 3 *a*).

(2) The thickening reticulum may grow faster than the calicles, causing the interstices to swell up into ramparts surrounding pits, in the bases of which the calicles open. I have called this the "foveolate" group, after the most extreme type, *M. foveolata* of Dana.

Between these two come specimens which are foveolate while in rapid growth, but eventually become smooth ; these I have called "glabro-foveolate." I have found some twelve foveolate types and five glabro-foveolate.

One specialization of these ramparts has a curious resemblance to true protuberant calicles. This appears to have misled Dana in his ascription of true calicles to *M. caliculata*.

(3) The thickening reticulum shoots up into papillæ which rise up above the general surface. There are several more or less distinct variations of the "papillate" specialization, which at the moment of writing is shown by at least thirty-three types (fig. 3 *b*).

The leading differences are as follows :—(*a*) reticular uprisings froth up the interstices over irregular patches of different sizes ; (*b*) the papillæ are always in some relation to calicles, forming hoods or mounds, on the outer faces of which calicles open ; (*c*) the papillæ run together to form either nearly parallel series in the direction of growth, or else more or less gyrating ridges ; (*d*) lastly, as the extreme type, the papillæ rise as nipple- or nearly symmetrically dome-shaped processes scattered more or less thickly over the surface, but not arranged in radial series (fig. 3 *b*).

(4) The thickening reticulum undergoes a change in its texture ; the threads which bend up vertically become differentiated from the rest of the elements of the reticulum and

become stout solid trabeculæ. The rest of the reticulum merely forms the cross pieces which support these trabeculæ. Every stage in the gradual differentiation of these trabeculæ can be traced. In many cases the more vertical elements of the thickening reticulum run in nearly straight lines, but without thickening. Comparison of specimens shows that the thickening was due to the rising up of the tips of these vertical threads above the surface, perhaps at first as echinulæ. These became stouter and stronger, probably for protective purposes, and thus, as they sank beneath the rising surface, became thick trabeculæ (fig. 3 *c*).

This group, showing the rising of stout trabeculæ above the surface to form protective "tubercles," is very large and contains more than forty types. The distribution and shapes of the tubercles are very varied: they may be densely crowded as minute rounded granules or tall and lancet-shaped; they may be grouped in rings round calicles, or, again, they may run together to form thin keels or ridges. This group is called the "tuberculate" group.

We thus have four main divisions of the genus—glabrous, foveolate, papillate, and tuberculate—each term having reference solely to a peculiar specialization of the cœnenchyma. While the first three of these terms need no comment, the last requires justification.

In all the earlier descriptions of Montiporan types the terms papillæ and tubercle seem to have been used indiscriminately. It is often impossible to tell whether a writer was describing a specimen belonging to group 3 or to group 4. The most important use of the word tubercle occurs in Lamarck's description of the specimen *Porites tuberculosa*, Lk. (=*Montipora tuberculosa*). In fixing the use of the word tubercles to mean the small solid tips of individual trabeculæ when they project above the surface, I have been led to do so by the conviction that these were Lamarck's "tubercles" as seen on his type "*tuberculosa*." Certain expressions in Lamarck's text point clearly to this. In describing *P. tuberculosa* * he speaks of "les tubercules dont la surface est parsemée" as being "graniformes ou columniformes;" and, again, on the next page he speaks of interstices being "hérissés de tubercules." Both these expressions are quite inapplicable to the much larger swollen reticular knobs here called papillæ.

One other remark on these tubercles with their trabecula-like sunken portions. It was the presence of these trabeculæ which appears to have misled Milne-Edwards. He compared

* 'Animaux sans Vertèbres,' ii. 1816, p. 272.

them with the entirely different trabeculæ of *Porites*, and accordingly placed *Montipora* among the Poritidæ. So far as my own observation goes, the two are morphologically distinct; the trabeculæ in *Porites* are primitive structures, rising straight up from the epitheca, while in *Montipora* they are, as we have seen, quite secondary.

Turning from the cœnenchyma to the polyps, polyp-cavities, method of budding, and to the forms of the corallum, points which are, as a rule, of prime importance, we find that the special development of the cœnenchyma has, as it were, overshadowed them. With regard to the last-named, we find all the typical methods of growth in each of the four chief divisions based upon the specializations of the cœnenchyma. The polyps themselves are minute and their tentacles are little more than papillæ or crenulations of the edge of the oral disk. The polyp-cavities are also very small and the septal apparatus as a rule degenerated into mere vertical rows of projecting spines. The largest or directive septum with a few of the larger primaries may be more or less interruptedly laminate. I look upon these as survivals of a primitive laminate condition of the septa and costæ in the thick porous walls. The cause of this degeneration of polyps and septal apparatus may perhaps be correlated with the great development of the cœnenchyma, the production of which must be a strain on the resources of the living organism, leading to the fixation of the polyp at a very undeveloped stage. In contradistinction to this extreme we may cite in support of our suggestion the cases of the *Alcyonaria* and *Actinia*, in which the polyps reach a very high level of development, while the skeletal matter deposited is either scanty or altogether absent.

The character of the budding, as also a few further points on the degeneration of the septal apparatus, will be referred to in the concluding section on the interrelationships of the Madreporidæ. In that connexion such matters can be more advantageously discussed comparatively. We shall there also summarize the description of the genus above given, and in that way emphasize the arguments in favour of classing *Montipora* with the Madreporidæ.

The Genus Anacropora.

This genus, founded by Ridley in 1884 (*l. c.*) to contain a branched coral from Keeling Island, was said to be distinguished from *Madrepora* by the method of budding and from *Montipora* by its protuberant calicles.

The method of budding in *Madrepora*, in which smaller

daughters appear from the sides of larger parent ("apical") polyps, was described as centrifugal, while that in *Anacropora*, in which an apex of undifferentiated cœnenchyma takes the lead and the young polyps appear in it as it grows, was called centripetal. The distinction was thought to be fundamental. On the other hand, the new genus came very near *Montipora*, differing from it chiefly in the fact that the calicles in *Montipora* are typically immersed, while in *Anacropora* they bulge up the surfaces of the branches into mounds or eminences.

The new genus was accepted at once by Duncan in his revision of Milne-Edwards and Haime's system, and he allied it with *Montipora*.

The 'Challenger' expedition brought home two new types, which Quelch classed under Ridley's genus, and in 1892 Rehberg* added another specimen and type, bringing the number up to four. The following notes are based upon the study of the specimens and fragments (twenty-two in all) in the National Collection. These include all the existing types except that of Rehberg (*A. spinosa*), which is in the Hamburg Museum. The examination has resulted in the establishment of two new types, one being represented only by fragments, the bulk of the specimens being in the Vienna Museum. Full details will appear in the official catalogue, which is in the press.

I was for some time quite uncertain as to the validity of the distinction made by Ridley between *Anacropora* and *Montipora*. Slight mounds or elevations on which the calicles opened might and do, indeed, occur in *Montipora*, wherever the corallum is very thin, while, on the other hand, we have in *Anacropora* the streaming axial layer leading the growth, and forming, as in *Montipora*, the tips of branches, and a further cortical layer formed just as in *Montipora*. It seemed to me, therefore, that while the fundamental identity in the structure of the colonial skeleton showed that *Anacroporæ* were really Montipores, the presence of protuberant calicles, which might be a slight return to primitive conditions, hardly justified the establishing of a new genus. Comparison with other types and with the undescribed material in the collection has, however, revealed other characters which are important enough to warrant our retaining the genus, but uniting it with *Montipora* under a subfamily Montiporinæ.

While, then, the fundamental identity in the structure of the cœnenchyma shows that *Anacropora* has branched off

* Abh. Nat. Ver. Hamb. xii. p. 46.

from *Montipora*, we may assume that the protuberant calicles, which may, in some cases, be even tall and conical, suggest that this branching off took place at a very early stage in the development of that genus. That these protuberances are primitive, and not secondary returns to primitive conditions, may, perhaps, be gathered from the very important fact that the primary septa in the more protuberant calicles are laminate, and, further, that these laminate radial structures may even project down the outer wall of the protuberance as costal ridges (Pl. II. fig. 5). It is specially worthy of note that the less protuberant calicles, or those which open flush with the surface, have the degenerated septal apparatus characteristic of *Montipora*, while those which grow taller and slightly larger develop radial skeletal laminæ, septa and costæ. While it is of course quite possible that this is a secondary return to primitive conditions, there is no reason why we should not assume it to be the persistence of such conditions. The burden of proof, I think, rests with those who prefer the former suggestion.

I have been much struck by noting that many of the protuberant calicles with costal ridges running down their sides show the tendency to a spiral twisting of the whole calicle which I have already referred to in *Turbinaria* and *Madrepora*. This fact, again, seems to me to suggest that the protuberance of the calicles is primitive and not atavistic.

Hence, then, we conclude that *Anacropora* branched off from *Montipora* before the degeneration of the calicles and of their laminate radial skeleton had gone as far as it now has in the latter genus.

In this connexion it is worth noting that the axial streaming layer is typically laminate or band-like, and that, in those cases in which it appears most filamentous, examination shows that this is a secondary condition due to the formation of large perforations in the primitive longitudinal bands. This band-reticulum, as we have seen above, can be best traced to the outward streaming of the primitive laminate radial structures composing the chief portion of the thick walls of the parent and daughter polyps in the earlier stages of colony formation.

In addition to this important laminate structure of the walls of the more protuberant calicles, the method of branching is quite peculiar. All the known types are composed of rather thin cylindrical stems more or less knotted (by the protuberant calicles) like a thorn-stick. While the stems are generally slightly curved, the branches come off suddenly at rather wide angles, the stem at the same time bending

away from the branch. It is, in reality, a kind of forking, only the stem remains the more important and less diverging prong. The result of repeated branchings with free fusions between parts that touch is to form a rather closely matted tangle low down near the ground, the meshes in the tangle being more or less angular. This angular character of the meshes is, however, frequently obscured by curvings of the branches. Broken fragments falling down into the tangle freely fuse on again, and help to make the net thicker. In claiming this very peculiar method of growth as characteristic of the genus I am aware that it is not immediately evident in all the types. It is very marked in Ridley's original type (*A. Forbesi*), in Quelch's types (*A. gracilis* and *A. solida*), and in one of the new types (*A. echinulata* *), whereas it is not so marked though traceable in *A. erecta* *, and apparently least visible in Rehberg's type (*A. spinosa*). In these last two forms the branching does not come off at such a wide angle, and hence the whole corallum is more symmetrically arborescent. But in *A. erecta*, so far as I remember the photographs shown me by Dr. Marenzeller, the larger clumps were very close tangles of thin knotted stems, and Rehberg's figure of *A. spinosa* (*l. c.*) appears to show distinct traces of a tendency to sudden angular bendings of the stems and branches.

These points, then, the protuberant calicles, showing distinct lamination of their radial structures, and the peculiar character of the branching, serve, I think, to separate *Anacropora* from *Montipora*, with which genus it is, however, fundamentally associated in the structure of the cœnenchyma and in the presence of calicles with degenerate septal apparatus exactly like those of *Montipora*.

Interrelationships of the Madreporidæ.

As we have above seen, the only argument for allying *Montipora* with *Porites*, as was done by Milne-Edwards and Haime, and later by Duncan, falls to the ground as soon as the secondary character of the trabeculæ is established †. Hence we have no hesitation in claiming the genus with its ally *Anacropora* as together forming a subfamily of the Madreporidæ. I shall now endeavour to show that the remaining three accepted genera—*Madrepora*, *Turbinaria*,

* Full descriptions of these are given in the Museum Catalogue.

† In 1889 Dr. Ortmann suggested, without going into details, that *Montipora* might be deduced from *Porites* through *Alveopora* (Zool. Jahrb. (syst.) iv. p. 584).

and *Astræopora*—can be usefully united in a second subfamily; so that, for the future, the Madreporidæ will consist, so far as we at present know, of two subfamilies—the Madreporinæ, comprising three genera, and the Montiporinæ, comprising two genera.

The strongest argument in favour of this classification lies in the fact that the five genera can be deduced from a common ancestral form. In describing this form we are, for obvious reasons, confined to a consideration of its parent polyp, and not of its colony. Every colony starts from a parent polyp, and, indeed, receives its chief characteristic from the structure, growth, and method of budding of this individual, directly developed from the attached larva. Hence it is enough if we can trace any group of colony formations back to a common ancestral parent polyp.

Reference to the analyses already given in this and in the earlier papers on *Turbinaria* and *Astræopora* shows that this common parent polyp possessed the following leading characteristics:—(1) a porous wall, with laminate radial structures; (2) a well-developed saucer-shaped epitheca; (3) the habit of very early budding while the parent polyp was still very small; (4) the production of true buds, starting from the smallest beginnings out of the sides of the polyp, and forming their skeletons, at least in the first stages, upon and with some slight modification of the radial symmetry of the porous wall of the parent polyp*.

From such a form we may deduce the genera under discussion along the following lines of specialization:—

Madrepora.—The skeleton of the parent polyp grew in height, and consequently somewhat in size, shooting upwards in a tall cone with thickening base (fig. 4*a*). The buds grew out in tiers from its sides, remaining comparatively small. The radial structures persist as laminæ, and those septa of the buds would be largest which could start at once upon, and in the same plane with, one of the radial laminate structures (costæ) of the parent; hence the "directive" septa of the buds are typically radially symmetrical with those of the parent. The epitheca is left behind.

Turbinaria.—A ring of buds shoots up round and from the sides of the parent polyp, together forming a cup, the wall of each bud rising up as a distinct cone above the level of the fusion of their walls to form the common cœnenchyma (fig. 4*b*).

* For Miss Ogilvie's alternative derivation of the Madreporidæ see Phil. Trans. vol. clxxxvii., 1896. This has been criticized by me in the Geological Mag. vol. iv. 1897, p. 170.

The parent polyp dies away, and its primitive protuberant cone is immersed under the cœnenchyma formed from the fusion of the walls of a ring of daughters. These daughters carry on the colony, the budding of the daughters being limited to their free or outer sides, *i. e.* to the sides turned away from the axis of the cup. Hence the fact referred to above, that in *Turbinaria* as well as in *Montipora* the young buds appear in the undifferentiated cœnenchyma which forms the growing edge of the cup. This edge represents morphologically the outer sides of the combined porous walls of the last-formed ring of polyps, and differs from the porous wall of the parent polyp mainly in the facts, (1) that the laminate radial structures are more or less obscured, and (2) that the epitheca has been left behind. The polyps forming the Turbinarian colony develop equally, and there is no such disparity in size as is seen between the axial polyp of *Madrepora* and its daughters. Principal or directive septa occur and can be accounted for in the same way as in *Madrepora*.

Astræopora.—The budding is promiscuous; a new bud develops wherever there is room for it, each one typically carrying up its wall into a protuberant cone (fig. 4 *c*). As a result of this crowding the known forms are, without exception, thick encrusting, or massive. The costal radial structures of the original parent ceased to be laminate, but broke up into radial series of spines, the tips of which formed protective echinulæ. One apparently natural consequence of this was a considerable degeneration of the septal apparatus in the daughters of the colony.

Montiporinæ.—The original parent polyp was distinguished by great thickness of its porous walls, which apparently early arrested the development of the polyp, and by a tendency of the whole skeleton to be low, and even perhaps disk-like, and not to rise up into a cone as in the last three genera (fig. 4 *d*). In the modern Montipores this has reached its extreme limit, but in *Anacropora* the habit of forming conical walls is not yet lost. The synapticular connexions between the radial structures reached far in towards the centre, so that the visible septal apparatus tended to be limited to rows of septal spines; when the calicles protrude (*Anacropora*), and hence grow a little in size, laminate septa appear. The tendency to enormous thickness of porous wall was inherited by the daughter polyps. Hence the two chief characteristics of the genus—(1) minuteness of the polyp-cavities, (2) great richness of cœnenchyma, which is nothing but the result of fusion of the greatly thickened porous walls of the individuals of the colony. The budding

of the daughters seems, as a rule, to be limited to their free or outer sides; the fresh buds turn upwards if the growing edge is accompanied by an epitheca, but may turn up or down indifferently if the growing edge is free. In the diagrams the former case is, for the sake of simplicity, alone illustrated.

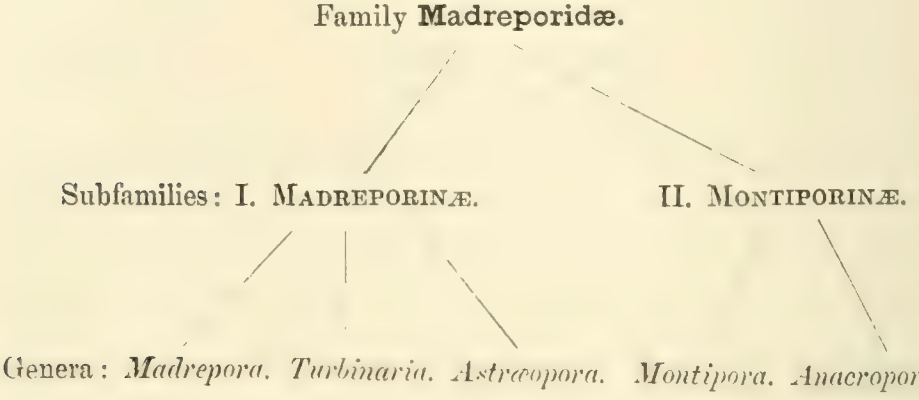
In *Montipora* we have almost all possible growth-formations resulting from this aggregation of small thick-walled polyps, aided by the secondary additions of tissue, above described as the "thickening layers." These begin to form at varying distances from the growing edges or apices, *i. e.* after the budding of the polyps has ceased. May not this fresh growth be correlated with the very early budding of the Montiporan polyps and their subsequent continued but limited growth—limited, that is, by the abundant secretion of skeletal matter—which is the characteristic feature of the genus?

In *Anacropora* the growth-form is highly specialized. We may thus look upon *Anacropora* as a survival of a special growth-form of some more primitive Montipore, *i. e.* of some Montipore in which the degeneration of the protuberant conical wall had not gone so far as it has in the modern representatives of the genus. While in *Montipora* the laminate radial elements of the calyx have almost entirely disappeared, being only occasionally found in a few large primaries, directives and others, and, again, in the streaming layer of the cœnenchyma, in *Anacropora* laminate septa and costæ appear in the more protuberant calicles in addition to the lamination of the streaming axial layer. It is further worth noting that not only does the occasional presence of laminate directives support the deduction of *Montipora* from an ancestral polyp with laminate radial skeleton, but the mere presence of directives points also that way, that is, if the explanation of the rise of directives above given is correct. The primitive epitheca, which is lost in *Anacropora*, persists and plays a great part in the formation of many Montiporan coralla.

In these different ways all the genera which are at present included in the Madreporidæ can be deduced from a common parent. The two last mentioned are associated by the peculiar structure of the cœnenchyma, which, as we have seen, is traceable to the great thickness of the porous walls of the individual polyps. These, then, form the subfamily Montiporinæ. The remaining three genera are also united by one character in common, viz. the typical upgrowth of the polyp-walls into freely protuberant calicles, their basal portions alone being fused together to form a cœnenchyma. I can see no reason why this character should not unite *Madrepora*, *Turbinaria*, and *Astræopora* into a second subfamily—the

Madreporinæ. The chief objection to this rests in the specialized character of the laminate radial structures of *Astræopora*, which ought, perhaps, to separate that genus from *Madrepora* and *Turbinaria*. In the meantime, however, they can be usefully united in the manner suggested.

I therefore suggest the following arrangement of the family :—



A serious objection may be raised to this description of the phylogeny of the Madreporidæ, viz. that it is apparently based exclusively upon study of the five genera dealt with. It is true that such a limitation of one's survey makes all generalizations hazardous. I am, however, encouraged to state the conclusions I have arrived at with regard to these genera even at this early stage because they are not based solely upon study of the five genera concerned. Most of the other Madreporarian genera—at least, the better known of them—have been studied and compared again and again for the express purpose of arriving at some clear insight into the different lines along which the stony corals have been differentiated. I am aware that this does not appear from anything said in this paper. I have, however, here purposely abstained from making any definite morphological statement about any genus which I have not studied systematically. The survey of a few specimens of any particular genus may give reliable hints for guidance towards a better understanding of the genera which are at the time the object of close study, but cannot be exact enough to admit of definite assertion. It is, indeed, quite possible that when all the available specimens of the genus *Porites* have been under review, the purposely very limited reference to the morphology of that genus given above may have to be qualified.

EXPLANATION OF PLATE II.

Figs. 1, 2. Youngest colony of *Montipora* found, 3·5 millim. in long diameter: *pp*, the largest and tallest calicle, presumably that of the parent polyp of the colony. The saucer-shaped epitheca has been turned in, and the outward growth at *a* has been hindered; hence the initial symmetry has been destroyed, the young stock having expanded chiefly in the direction of *b*.

Fig. 3. Diagrams showing the building up of the Montiporan corallum. The budding of the thick-walled polyps is shown by lines; the originally laminate septa and costæ lying in the plane of the paper are covered with curved dotted lines, to represent the ordinary appearance of the basal streaming layer in sections at right angles to the growing edge. The tissue which secondarily thickens the corallum is:—

(*a*) A reticulum which does not rise above the level of the calicles.

(*b*) A reticulum which surges up to form spongy ramparts or papillæ.

(*c*) A reticulum of which the more vertical elements are straightened and thickened and project above the surface as tubercles. In these figures the streaming layer has been drawn very thick for the sake of clearness. In reality the relative thicknesses of the layers should be reversed, the streaming layer being, in many cases at least, the thinner.

Fig. 4. Diagrams to show the different specializations in form and method of budding of the parent polyp, which will explain the leading characters of the four chief Madreporidan genera:—(a) *Madrepora*, (b) *Turbinaria*, (c) *Astræopora*, (d) *Montipora*.

Fig. 5. A protuberant calicle of *Anacropora gracilis* (× ca. 20), showing the laminate septa and the edges of the costæ running down the outer walls.

XII.—*Contributions from the New Mexico Biological Station.* —VI. *The New Mexico Bees of the Genus* Heriades, *and a new* Halictus. By T. D. A. Cockerell.

The bees herein described all fall under *Heriades* in the broad sense, but they present considerable differences, which might be considered of subgeneric or even generic value.

A. *Legs partly red.*

a. Smaller species, the red confined to the front legs.

Heriades asteris, sp. n.

♂. Length about 5 millim.

Black, with the anterior femora in front and within and the broadened anterior tibiæ behind ferruginous. The whole insect very coarsely sculptured, the punctures of the vertex and mesothorax extremely large, producing a subcancellate

effect, just as in *H. carinata*. Head rounded, not particularly swollen behind the eyes; cheeks beneath and anterior margin of clypeus each with a large and dense brush of white hairs; anterior margins of eyes, up to a distance above the level of the antennæ equal to the length of the scape, bordered by a conspicuous white hair-band; vertex and the rest of the face almost free from hairs, but some scattered pubescence above the level of the antennæ; antennæ long, flagellum brownish beneath, its first two joints about equal, the third somewhat longer; clypeus much more finely punctured than the face above. In another specimen the clypeus is covered with white hair and the face is more hairy. Thorax very little hairy, the white pubescence most noticeable about tubercles and along the hind margin of scutellum, but dense on the ventral surface between the legs. Tegulæ shining piceous. Wings rather short, rather dusky, especially along the costa beyond the stigma, beautifully iridescent; nervures and stigma piceous, stigma moderately well developed, first recurrent nervure reaching second submarginal cell only just beyond the origin of the first transverse cubital. Abdomen with distinct but narrow white hair-bands, its dorsal surface with very large punctures. It does not end in four projections, but is similar in general structure to that of *H. carinata*.

Hab. Las Cruces, N. M., on *Aster spinosus*, August (Ckll. 4626), and on *Solidago canadensis*, Sept. 3 (Ckll. 4748).

b. Larger species, the red practically confined to the four hindmost legs.

Heriades bigeloviæ, sp. n.

♂. Length about 5½ millim.

More bulky than the last, the head quite large, though not notably extended behind the eyes. Black, with the middle and hind femora and the hind tibiæ and tarsi bright ferruginous. Pubescence white, tolerably abundant, quite covering the face up to a little below the middle ocellus, dense on the cheeks beneath and along margins of mesothorax, scutellum, metathorax, and pleura; the disk of the meso- and metathorax nude, not so the pleura; abdominal segments with very distinct apical hair-bands, snow-white, the first much broadened at the side; legs more or less white-hairy. Punctuation of vertex, thoracic dorsum, and abdomen strong and tolerably close, but not nearly so large or coarse as in the *carinata* group. Basal enclosure of metathorax smooth, shining, impunctate. Tegulæ testaceous, pubescent. Wings perfectly hyaline, nervures and stigma piceous. Stigma

very little developed, first recurrent nervure joining second submarginal cell at a distance from the origin of the first transverso-cubital nervure greater than half the length of the latter. Abdomen suboval, without a subbasal ventral projection; apex with four approximately equidistant teeth, the median ones not broadened.

♀. Similar to the male, with a white ventral scopa. Ventral base of abdomen with a short tooth-like projection. Antennæ shorter.

Hab. Las Cruces, N. M., on *Bigelovia Wrightii*, Sept. 23, a male. Also a male, June 16, on *Aster spinosus* (Ckll. 3036). A female was taken as early as April 27 on the occasion of a meeting of the Agricultural College Field Club.

This species belongs to an entirely different group from *asteris* &c.

B. *Legs entirely black.*

a. First recurrent nervure uniting with first transverso-cubital.

Heriades crucifera, sp. n.

♂. Length about or slightly over 6 millim.

In appearance, structure and punctuation, &c. this is like the male of *carinata*, but it differs as follows:—

crucifera ♂.	*carinata* ♂.
First recurrent nervure uniting with the first transverso-cubital.	First recurrent nervure not so uniting.
First ventral segment of abdomen shovel-shaped, viewed laterally not unlike the head of the snake *Heterodon nasicus* upside down.	First ventral segment of abdomen produced into a large blunt tooth, erect and a little excavated posteriorly.
Face a little narrower; clypeus only fringed with white hair.	Face a little broader; clypeus covered with white hair.

Hab. Santa Fé, N. M., July 18 (Ckll. 1546).

b. First recurrent nervure reaching second submarginal cell at a point distant from the origin of the first transverso-cubital less than half the length of the latter. Thorax usually very coarsely sculptured. Stigma distinct. Wings smoky at apex.

Heriades carinata, Cresson, 1864.

I have an Illinois specimen from Mr. Robertson, and it agrees with the insect as found in New Mexico. Females are before me from the following places:—(1) Santa Fé, N. M., Aug. 2 and 3, at flowers of *Grindelia squarrosa*, three;

(2) Santa Fé, Aug. 3, one on *Solidago canadensis*; (3) Socorro, N. M., June 29, one on a species of Compositæ; (4) Las Cruces, N. M., Sept. 3, one on *Solidago canadensis*; (5) Las Cruces, June 16, on *Aster spinosus*; (6) Mesilla, N. M., Aug. 15, one on *Solidago canadensis*; (7) Mesilla, Aug. 29, on *Bigelovia Wrightii*; (8) Colorado Springs, Col., middle of July. The specimens from Santa Fé and Colorado Springs seem to average larger than those from the Mesilla Valley. Of the male I have three examples from Ruidoso Creek, collected by Prof. E. O. Wooton, one on *Veronica*, sp., July 1; one on *Erysimum*, at 6600 feet, July 3; one on *Rhus*, at 6600 feet, July 10. It will be noted that the females were all taken on Compositæ, but not so the males. The species apparently does not fly earlier than about the middle of June.

Heriades gracilior, sp. n.

♀. Length 8 millim. or slightly over.

Black; abdomen long and rather slender, with parallel sides. Pubescence dirty white, scanty and inconspicuous on head and thorax, most abundant about tubercles, hind border of scutellum, and round the antennæ. Punctuation strong and moderately dense, but not nearly so coarse or dense as in *carinata*; the shining surface of the mesothorax is plainly evident between the punctures, and still more is that of the abdomen. Head longitudinally broad-oval; clypeus strongly punctured, bulging, with more or less of a central ridge; mandibles very broad, with a conspicuous prominence on the outer side not far from the base; antennæ entirely dark; flagellum slightly inclined to be flattened. Metathorax obliquely truncate, the upper edge of the truncation shining. Tegulæ shining piceous. Wings smoky hyaline, darkest in and just beyond the marginal cell. Venation as in *carinata*, except that the marginal cell is relatively longer and narrower. Legs sparsely hairy. Abdomen with very distinct but very narrow white hair-bands. Ventral scopa white, not very abundant.

Hab. At flowers of *Opuntia* with *H. opuntiæ*, Soledad Cañon, Organ Mountains, N. M., May 22 (*Ckll.*).

A considerably larger insect than *H. carinata*; it is of the same group, though it exhibits a style of punctuation more common in the next group.

c. First recurrent nervure reaching second submarginal cell at a point distant from the origin of the first transverso-cubital more than half the length of the latter. Stigma small or subobsolete. Wings not smoky at apex.

i. Large species, tegulæ dark ferruginous.

Heriades opuntiæ, sp. n.

♀. Length about 10 millim.

Black, with white pubescence. Punctuation throughout strong, but fine and close, yet not close enough to prevent the surface from shining. Pubescence conspicuous only round antennæ, at sides of face, on cheeks beneath, on and above tubercles, on anterior part of mesothorax, along margins of pleura, in a line above the wings, continuous along hind margin of scutellum, along lateral edges of metathorax, on coxæ, femora beneath, tibiæ and tarsi rather thinly in front, and in the abdominal scopa and the five white narrow bands above. All this is white, but the tarsi on the inner side are clothed with orange-rufous hairs. Head very large, subquadrate, seen from in front as large as the lateral view of the thorax, broad behind the eyes, closely punctured on the vertex and cheeks, but with larger much sparser punctures on the shining clypeus. Antennæ short, flagellum faintly brownish towards the end. Mandibles very broad, the long oblique inner edge ornamented with appressed ferruginous hairs, and presenting a tooth about its middle. There is no sort of prominence on the outer side. Eyes bicoloured, black in front, sage-green behind. Tegulæ shining dark ferruginous. Wings clear, nervures and stigma black, stigma extremely small. The anterior margin of the clypeus is perfectly straight, and beneath it are some very bright orange-ferruginous hairs. The base of the metathorax is smooth and shining. The tibial spurs, which are pale yellowish brown in *H. gracilior*, are so only on the front legs of *opuntiæ*, on the others being black. The four anterior tibiæ in *gracilior* come to a decided point at the end on the outer side at an angle of perhaps 50°; but in *opuntiæ* they exhibit at the same place a short but slender spine, slightly curved upwards. The hind tibiæ are slightly nodulose on the outer side in *gracilior*, not so in *opuntiæ*.

Hab. At flowers of *Opuntia*, Soledad Cañon, N. M., May 22 (*Ckll.*). At one time I took this for *H. rotundiceps*, Cresson; but on comparing it closely with Cresson's description, it is evidently distinct.

ii. Smaller, tegulæ black or piceous.

Heriades prosopidis, sp. n.

♀. Long. 5 millim.

Black, of the usual form; abdomen with narrow white hair-bands. Head large, subquadrate; vertex shining, with large extremely close punctures; face somewhat hairy, sides of face covered with white plumose hairs, forming very conspicuous patches; clypeus punctured, more or less clothed with silvery hairs; mandibles dark, grooved without; antennæ short, wholly dark; eyes sage-green, except the anterior two-fifths, which are intense black. Thorax shining, strongly and closely but not confluently punctured; pubescence scanty over most of the surface, but forming patches in front of and above wings and at sides of metathorax, the pleura also being margined with white hairs. Tegulæ shining piceous. Wings iridescent, perfectly hyaline; nervures and stigma black, stigma quite small. Legs black, sparsely hairy, the four hindmost tarsi clothed within with ferruginous hairs. Abdomen rather shiny, strongly and rather closely punctured, with four conspicuous but very narrow white hair-bands. Apical segment thinly clothed above with short silvery hairs. Ventral scopa white. First ventral segment with a thorn-like prominence. Mandibles broad and tridentulate at apex.

Hab. Mesilla, New Mexico, three at flowers of mesquite (*Prosopis*), in company with *Prosopis mesillæ*, *P. asininus*, and *Perdita exclamans*, May 7, 1896.

I have also a single male, taken at Las Cruces, N. M., June 16, on *Aster spinosus* flowers; it is like the female, but somewhat smaller, with a more densely pubescent face, longer antennæ, and the tip of the abdomen exhibits four short teeth. This little species could be taken for *H. variolosa*, Cresson, but the punctures of the third abdominal segment are no larger than those of the second.

Heriades cactorum, sp. n.

♀. Length about 6 millim.

Uniformly larger than *H. prosopidis*, but very similar to it. The pubescence of the face forms two very conspicuous white bands at the sides and is fairly abundant about the antennæ; it does not at all conceal the surface of the clypeus. The punctuation of the pleura is somewhat closer than in *prosopidis*, and the stigma is perhaps rather smaller. The flagellum becomes tinged perceptibly with dark brown. The eyes are

bicoloured, as in *prosopidis*. The second and third segments of the abdomen are punctured alike.

Hab. Santa Fé, N. M., July 10, three at flowers of *Cactus radiosus*, var. *neomexicanus* (Eng.), in Mr. Boyle's garden; they burrowed deeply down among the anthers. One at Colorado Springs, Colorado, middle of July.

This species does not appreciably differ from *H. prosopidis*, at least in the female, except in the characters given above; yet I believe it is certainly a different species. I have a series of each, and the differences are constant; the bees also occur on different kinds of flowers in different life-zones.

Heriades meliloti, sp. n.

♂. Length about 6½ millim.

Stoutly built; head large, seen from in front almost exactly circular; eyes bicoloured green and black, face covered with white hairs; vertex with very sparse silvery hairs, shining, strongly but only moderately densely punctured; antennæ not very long, flagellum only very feebly brown; mandibles deeply bifid at ends, the two teeth sharp, no indication of a third; thorax not densely but quite copiously white-hairy; mesothorax with strong quite close punctures, similar punctures on scutellum not so close; tegulæ shining piceous; nervures and stigma black; wings hyaline; base of metathorax smooth and shining; small joints of tarsi rufescent; abdomen with strong and tolerably close punctures, similar on the second and third segments; the narrow white hair-bands very distinct; apex with four equidistant teeth, of which the two middle are the larger, but are not broadened. Venter with two white hair-bands; subbasal projection not very large, hairy.

Hab. Four in the Mesilla Valley, N. M., near Las Cruces. One was on *Melilotus indica*, on the College Farm, early in May; two were on the College campus, Sept. 10, at the same spot as a lot of *Plenoculus Cockerellii*, Fox *.

H. meliloti differs from the male of *H. prosopidis* at once in its considerably larger size, the much larger head, and relatively shorter antennæ. It is a somewhat larger insect than even the female of *cactorum*, so it is not likely to be its male, especially since it was found in a quite different locality.

The male of *H. osmoides*, Cresson, which I took at Colorado

* The *P. Cockerellii* were flying rapidly over the sand only a few inches above the surface and burrowing in it. I saw two making a great fuss, and found they were struggling for the possession of a small caterpillar.

Springs, Colorado, at the middle of July, is distinguished from *meliloti* by its considerably larger size and the fact that the two middle teeth at the end of the abdomen are considerably broader than long.

I have a single female from Soledad Cañon, in the Organ Mountains, which I think must belong to *meliloti*. It was collected by Prof. C. H. T. Townsend on Aug. 15 on *Melampodium cinereum*, DC. (det. E. O. Wooton); it is extremely like Sta. Fé *cactorum*, but larger, about 6½ millim. long, and has a noticeably larger head and broader face.

Halictus ruidosensis, sp. n.

♀. Length 6 millim.

Head and thorax very dark Prussian green, abdomen and legs black. Head ordinary, face broad; eyes converging above and below, so that the inner orbital margin is noticeably curved; face and front rough from the strong and extremely close punctuation, dark blue-green; except the clypeus and supraclypeal area, which are olive-green with a coppery lustre, the anterior margin of the clypeus broadly black. The punctuation of the lower parts of the face is also much less close than that above, and the clypeus and supraclypeal area are minutely roughened with strong but quite sparse punctures. Mandibles dark rufescent at ends; antennæ wholly very dark brown. Pubescence throughout dirty white, with a faint yellowish tint, sparse on head and thorax, but conspicuous in certain lights, not at all concealing surface of face. Thorax dark blue-green, metathorax perhaps a little bluer than the parts in front of it; mesothorax minutely granular and strongly and quite closely punctured; a distinct median impressed line; with a strong lens in a good light the postscutellum and hind part of scutellum appear quite an olive-green and the metathorax deep blue-black, strongly contrasting; metathorax minutely granular, rather shining, truncate, the distinct crescent-shaped basal area bounded only by a rounded edge; basal portion of enclosure finely rugoseplicate. Tegulæ shining piceous, not punctured. Wings hyaline, iridescent, slightly dusky towards apex; nervures and stigma piceous. Legs black, tibial spurs rufous, hind legs quite densely pubescent. Abdomen moderately broad, brown-black; first segment sparsely and feebly punctured, remaining segments more closely but still feebly punctured; hind margins of segments so narrowly and feebly testaceous that it is not readily noticeable; no hair-bands, but sides of first three segments, and dorsum of hind part of third and all

fourth and fifth pruinose from a fine pubescence, which on the lateral bases of the second and third segments tends to form triangular marks.

♂. Like the female, abdomen narrower.

Hab. Ruidoso Creek, New Mexico; six collected by Prof. E. O. Wooton, viz.:—(1) no. 21, at 6600 feet, July 3, on *Erysimum*; (2) no. 49, a variety with the clypeus and supraclypeal area concolorous with the rest of the face, at 7500 feet, July 6; (3) no. 24, July 3, on *Mimulus luteus*; (4) no. 142, at 6600 feet, July 10, on *Rhus*; (5) no. 171, at 6600 feet, July 10, on *Rhus*; (6) no. 170, also on *Rhus* with the last.

La Tenaja, near Santa Fé, N. M., collected by Miss Myrtle Boyle.

Santa Fé, N. M., seven, as follows:—(1) Ckll. 1141, the only male I have, unfortunately without its head, on alfalfa, Andrews orchard, June 27; (2) Ckll. 3468, on *Linum Lewisii* in garden, July 12; (3) Ckll. 1407, July 10, Boyle coll.; (4) Ckll. 4242, Aug. 5; (5) Ckll. 4055, Aug. 2, on *Clematis ligusticifolia*; (6) Ckll. 4044 and 4046, Aug. 2, on *Solidago canadensis*.

Las Cruces, N. M., March 31, 1896, on *Sisymbrium*.

This is a species of the transition-zone, though a single specimen was taken at Las Cruces, in the Upper Sonoran. Ordinarily it is known especially by the dark nervures and stigma, not at all metallic abdomen, and contrasting colour of the clypeus and supraclypeal area. The stigma may be slightly pallid, a sort of rather dilute sepia, but never honey-yellow; in one example only, apparently conspecific (Wooton's no. 49), did the character of the clypeal coloration fail.

H. ruidosensis is very similar to *H. Ashmeadii*, Rob., from Florida, but the latter will at once be distinguished by the narrower face and the lively reddish-brown colour of the tegulæ; the second submarginal cell in *Ashmeadii* is much narrowed above, but in *ruidosensis* it is very little narrowed.

Mesilla, New Mexico, U.S.A.,
May 9, 1897.

XIII.—*Revision of the Pierine Butterflies of the Genus* Delias.

By A. G. Butler, Ph.D. &c., Senior Assistant-Keeper, Zoological Department, British Museum.

As recently as 1893 Ritter von Mitis essayed a revision of this genus in the German 'Iris,' pp. 100–153; he, however, overlooked two or three described forms, and his material evidently was far from rich enough to enable him to form a

just estimate as to the value of the characters upon which species had been based.

At the present time the collection of the Natural History Museum, though still far from perfect, possesses long series of the commoner species, and is chiefly weak in those of the Solomon Islands which have been described during the last few years. The generosity of Messrs. Godman and Salvin, whose collection of these butterflies is now incorporated with the National series, has filled up several blanks and greatly improved the representation of some of the more beautiful and rarer species. Therefore, as I have been asked to bring the account of this genus up to date while fresh from its study, I will try to do my best, reducing the synonymy as much as possible.

1. *Delias eucharis.*

Papilio eucharis, Drury, Ill. Exot. Ent. ii. pl. x. figs. 5, 6 (1773).
Pieris epicharis, Godart, Enc. Méth. ix. p. 153 (1819).

Fifty-two examples, of which twenty-four are from the Godman and Salvin collection. Seven other examples are in the Hewitson series. India and Burma generally. B. M.

This widely distributed and common species seems to vary very little.

2. *Delias ethira.*

Delias ethira, Doherty, Journ. Asiat. Soc. Beng. iv. p. 262 (1886).

Berhampore, Ganjam and Khasia Hills (nine examples). B. M.

Although most nearly related to *D. hierte*, this species may be regarded as tending to link the latter to *D. eucharis*.

3. *Delias hierte.*

Delias hierte, Hübner, Zutr. exot. Schmett. figs. 77, 78 (1818).
Var. *Thyca indica*, Wallace, Trans. Ent. Soc. Lond. 3rd ser. vol. iv. p. 351 (1867).
Aberr. ♀. *Thyca devaca*, Moore, P. Z. S. 1872, p. 566.

Forty-three specimens, of which twenty-one are from G. & S. coll.; also five in coll. Hewitson. India, Burma, and Siam. B. M.

This species is very variable on both surfaces, but especially on the under surface of the secondaries; the scarlet submarginal spots are always large and seven in number, but they are very well developed in some examples; the yellow colouring on these wings also varies from lemon to saffron, sometimes even tinged with scarlet on the abdominal

border, whilst Moore's *T. sonaca* (a full-coloured female) has the subcostal area and cell of secondaries red; this, however, I believe to be a more accidental discoloration, such as one sometimes sees in Pierine butterflies, and due perhaps to staining through the chance dropping of meconium from above as the insect rested below a twig; but at best a mere aberration. In some examples, especially where the yellow is deep in tint, it is confined to the inner half of the wing and partly divided from the scarlet submarginal spots by white crescents; in others these crescents are wanting; frequently the yellow covers nearly the whole of the paler portion of the wing, and (rarely) it entirely obliterates every vestige of white. In the spot to which Wallace gave the name of *Thyca indica* the black suffusion on the upper surface at apex of primaries is weakly defined and the black veins on the under surface of the secondaries are expanded by a bordering of black scales at the inner edge of the scarlet spots. None of these varieties are limited to any locality, excepting, perhaps, the variety without white on the underside of the secondaries, of which we only possess a female from Toungoo; a male from Rangoon has almost lost all trace of white, so that it is just possible that this variety may be confined to Burma.

4. *Delias metarete.*

Delias metarete, Butler, Trans. Linn. Soc. (2) i. p. 550 (1879).

Malacca, Penang, Borneo, Sumatra. B. M. Sumatra, coll. Hewitson.

This is a Malayan representative of *D. hierte*, approaching nearest to the var. *indica*, but the much more uniformly grey apical area of the primaries above, the more restricted and sharply defined limitation of the yellow area on the under surface of the secondaries, and development of the black inner bordering of the scarlet spots constantly distinguish it. Our series consists of eight examples, two of which are from the Godman and Salvin collection, also one in the Hewitson collection.

5. *Delias hæmorrhœa.*

Pieris hæmorrhœa, Vollenhoven, Mon. Pier. p. 10, pl. ii. fig. 5 (1865).

Three examples, Banca. ♂ ♀, B. M.

The more dusky bordering of the secondaries above, the orange instead of yellow colouring below, and restriction of the scarlet spots to three in number, readily separate this insular form from the preceding.

6. *Delias niasana*.

Delias niasana, Kheil, Rhop. Nias. p. 35, pl. iv. figs. 22, 23 (1884).
Var. *amarilla*, ibid. *t. c.*

Nias. Three examples. B. M.

Two of the specimens are from the Godman and Salvin collection. The species is a well-marked one, having the yellow on the under surface of the secondaries of a bright primrose tint, the submarginal scarlet spots almost enclosed in black and with pale edges; it approaches more nearly to *D. hyparete*, but is quite easily separated from that species by the form, pale edging, and number of the scarlet spots.

7. *Delias hyparete*.

Papilio hyparete, Linnæus, Mus. Lud. Ulr. p. 247 (1764).
Papilio autonoe, Cramer, Pap. Exot. ii. pl. clxxxvii. C, D (1779).

Assam, Penang, Borneo, Sumatra, and Java. B. M.

Thirty-four examples, of which thirteen are from the Godman and Salvin collection. The species varies chiefly in the size of the submarginal scarlet spots on under surface of secondaries, but not to any great extent.

8. *Delias luzonensis*.

Pieris luzonensis, Felder, Wien. ent. Monatschr. vi. p. 285 (1862).
Var. *Delias palawanica*, Staudinger, Iris, ii. p. 24 (1889).
Vars. *Delias mindanaensis*, Mitis, Iris, vi. p. 139, pl. ii. figs. 4, 5 (1893).

Philippine Islands and Formosa. B. M.

Eighteen examples, of which twelve were received from the Godman and Salvin collection. Hewitson also had four other specimens.

In its typical form *D. luzonensis* nearly resembles the darker examples of *D. hyparete* from Java (*D. autonoe*), but is at once seen to differ in the greater obliquity of the inner edge of the blackish apical patch, owing to its being carried backwards to the end of the discoidal cell; also (on the under surface) in the broader black border of secondaries, which completely encloses the scarlet submarginal spots, and the much greater extent of yellow on these wings. The species is very variable, easily divided into five forms, as follows:—

1. Typical form, with blackish apical patch to primaries streaked above with grey between the veins; secondaries below with six scarlet spots.—Luzon, Manilla, and Formosa.

2. Secondaries below with the second and third spots

whitish and small (female figured by von Mitis, Taf. ii. fig. 5, as *D. mindanaensis* ♀).—Luzon.

3. Secondaries with fewer scarlet spots—two to three in male, three large and two very small in female (male *D. mindanaensis*, fig. 4).—Mindanao.

4. Apex of primaries above crossed by more or less confluent broad white streaks, forming a belt crossed by black veins; secondaries below with six scarlet spots.—*D. palawanica*, Palawan.

5. Secondaries below with second and third spots small and whitish.—Mindoro.

That any of these forms is constant to locality may be doubted.

9. *Delias lucina.*

Delias lucina, Distant, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 270 (1887).
Delias joloana, Staudinger, Iris, ii. p. 24 (1889).

Sulu Archipelago. Two males from G. & S. coll.

10. *Delias simplex*, sp. n.

♂. Upperside resembling *D. Stollii* (*autonoe*, Stoll, not Cramer), but even less varied with black: wings below white, with black veins slightly expanded on the outer border of the primaries, and so much so on the secondaries as to form a continuous narrow sinuated border; internal third of secondaries pale chrome-yellow; *no red submarginal spots.*

Expanse of wings 82 millim.

Sumatra (*Sachs*). From G. & S. coll.

11. *Delias Stollii.*

Delias Stollii, Butler, P. Z. S. 1872, p. 32.
Papilio autonoe, Stoll (not Cramer), Pap. Exot. pl. xxxiii. figs. 2, 2 *b* (1790).

China. B. M.

Six examples, of which two were in the Godman and Salvin collection; the species is easily recognizable by the secondaries on the under surface being almost wholly yellow, combined with very small scarlet submarginal spots, bordered externally by a yellow edging, which separates them from the black of the outer border.

12. *Delias Rosenbergii.*

Pieris Rosenbergii, Vollenhoven, Mon. Pier. p. 11, pl. ii. fig. 6 (1865).
Delias chrysoleuca, Mitis, Iris, vi. p. 138 (1893).

Macassar. Three specimens. B. M.

One example from the Godman and Salvin collection.

Var. *Delias Lorquinii.*

Var. *Delias Lorquinii*, Felder, Reise der Nov., Lep. p. 159, pl. xxiv. figs. 9, 10 (1865).
Delias catamelas, Staudinger, Iris, iv. p. 77 (1891).

Menado. Four examples. B. M.
Also four specimens in Hewitson's collection.

Three of the examples of this variety or local race are from the Godman and Salvin collection; it chiefly differs from typical *D. Rosenbergii* in the black suffusion towards base of secondaries on the under surface, and was figured by Vollenhoven (pl. iii. fig. 1) as the female of that species; and he mentions both as coming from Macassar. The following may be a further development of the same species, the colour of the secondaries being variable.

13. *Delias Mitisi.*

Delias Mitisi, Staudinger, Iris, vii. p. 352 (1894).

Sula Islands.

Differs in having the basal half of secondaries below black, without yellow basal patch; the discal area white, only tinted with yellow at inner margin; submarginal scarlet spots larger.

14. *Delias melusina.*

Delias melusina, Staudinger, Iris, iv. p. 76 (1891), iii. pl. iii. fig. 5.

Celebes.

Seems nearly allied to *D. zebuda*, but with very melanic upper surface and yellow subapical spots on under surface of primaries.

15. *Delias zebuda.*

Pieris zebuda, Hewitson, Exot. Butt. iii. *Pier.* pl. vii. figs. 49, 50 (1862).

Menado and Ternate. Six examples. B. M.

Four of the specimens from the Godman and Salvin collection. In the Hewitson collection there are four more specimens from Menado and Tondano.

16. *Delias Descombesi.*

Pieris Descombesi, Boisduval, Sp. Gén. Lép. i. p. 465 (1836).

Darjiling, Nepal, Assam, Silhet, Moulmein, Toungoo, Tilin Yaw, Poungudaw, Pegu. B. M.

Twenty-eight examples, thirteen of which are from the Godman and Salvin collection. This species varies very little,

excepting in the ground-colour of the secondaries below, which, in the females, varies from buffish yellow to whitish. Five examples in the Hewitson collection.

17. *Delias oraia.*

Delias oraia, Doherty, Journ. As. Soc. Beng. lx. p. 189 (1891); Grose Smith & Kirby, Rhop. Exot. ii. p. 10, *Del.* pl. iii. figs. 5, 6 (1893).

Sumbawa Island (ex coll. G. & S.). ♂ ♀, B. M.

A well-marked local representative of *D. Descombesi*, the female being very distinct in character.

18. *Delias splendida.*

Delias splendida, Rothschild, Novit. Zool. i. p. 661 (1894); Smith & Kirby, Rhop. Exot. ii., *Del.* pl. vi. figs. 4–6 (1895).

Timor.

A very fine and distinct species of the *D. Descombesi* group.

19. *Delias belisama.*

Papilio belisama, Cramer, Pap. Exot. iii. pl. cclviii. A, B (1782).
Var. *Delias nakula*, Grose Smith & Kirby, Rhop. Exot. Pier. i., *Del.* pl. i. figs. 1–4 (1889).
Var. *Delias aurantia*, Doherty, Journ. As. Soc. Beng. lx. p. 189 (1891).
Delias belisar, Staudinger, Iris, iv. p. 78 (1891); Grose Smith & Kirby, Rhop. Exot. ii. p. 6, *Del.* pl. ii. figs. 6, 7 (1893).
Var. *Delias vestalina*, Staudinger (=*nakula*), Iris, iv. p. 79 (1891).
Var. *Delias erubescens*, Staudinger, *t. c.* p. 80.

Java. Twenty-six specimens. B. M.

Six examples are in the Hewitson collection. Eight of the specimens in the general series are from the Godman and Salvin collection.

Attempts have been made to show that the variations of this species are localized, but it is certain that Dr. Horsfield bred the typical form, *D. nakula* and *D. aurantia*, and there is no reason for supposing that he collected his larvæ in different parts of the island. *D. belisar* has been regarded as a variety identical with *D. aurantia*; it, however, differs in the greater width of the outer border of the secondaries in the male; the female does not differ: it is said to occur at Malang, and may possibly be a localized sport of the species. *D. erubescens* is probably a rare aberration; we have a small female of a very deep rosy orange colour (formerly in the Kaden collection). Intergrades occur between typical *D. belisama* and *D. aurantia*.

20. *Delias glauce.*

♂. *Pieris glauce*, Butler, P. Z. S. 1865, p. 431, pl. xxv. fig. 2.

Borneo. Type, B. M.

This species chiefly differs from the preceding in the absence of the subapical yellow markings from the under surface of the primaries. It is said to be common in Sumatra.

21. *Delias inferna.*

Delias inferna, Butler, Lep. Exot. p. 63, pl. xxiv. fig. 6 (1871); Grose Smith & Kirby, Rhop. Exot., *Del.* pl. ii. figs. 3–6.

Type N.W. Australia; two males and two females, Cape York and Port Moresby. B. M.

Twelve examples, of which ten are from the Godman and Salvin collection. Hewitson also possessed a pair which he mixed up with *D. aruna*.

22. *Delias aruna.*

♂. *Pieris aruna*, Boisduval, Voy. de l'Astr., Lép. p. 48 (1832); Hewitson, Exot. Butt. ii., *Pier.* pl. iii. figs. 20–22 (1861).

♀. *Pieris bajura*, Boisduval, *l. c.*

Two males and one female, Humboldt Bay; male, Batchian; male, Waigiou. B. M.

From the Godman and Salvin collection; there are also two males and a female in the Hewitson collection from Batchian and Waigiou.

23. *Delias Honrathi.*

♀. *Delias Honrathi*, Mitis, Iris, vi. p. 134, pl. iii. fig. 1 (1893).

Ralum, New Pomerania.

This may turn out to be only a dimorphic form of the female of *D. madetes*, from which it principally differs in the white instead of yellow ground-colour of the upper surface and in having most of the spots on the under surface of the primaries white.

24. *Delias madetes.*

Pieris madetes, Godman & Salvin, P. Z. S. 1878, p. 733.

Male and female, types (coll. G. & S.); male and female, New Ireland. B. M.

25. *Delias diaphana.*

Delias diaphana, Semper, Verh. Hamb. iii. p. 114 (1878): Reis. Phil. v. p 228, pl. xxxiv. figs. 3–6 (1890).

Mindanao and Davao. B. M.

Fourteen examples, of which twelve are from the Godman and Salvin collection.

The three following species stand out distinct from all the other forms of the genus, but combine characters of those which precede and those which follow them in this arrangement of the genus.

26. *Delias aganippe.*

Papilio aganippe, Donovan, Ins. New Holland, pl. xxix. (1805).

Adelaide, Sydney, Moreton Bay, &c. B. M.

Thirteen examples, of which seven are from the Godman and Salvin collection. Four other specimens in the Hewitson series.

27. *Delias harpalyce.*

Papilio harpalyce, Donovan, Ins. New Holland, pl. xviii. fig. 1 (1805).
Papilio Lewini, Thon, Entom. Arch. i. p. 38, pl. iii. fig. 10 (1828).

Australia, Sydney. B. M.

Nine examples, three of which are from the Godman and Salvin collection. Also three specimens in the Hewitson eries.

28. *Delias nigrina.*

Papilio nigrina, Fabricius, Syst. Ent. p. 475 (1775); Donovan, Ins. New Holl. pl. xix. fig. 1 (1805).

Sydney, Moreton Bay, Richmond River. B. M.

Ten specimens, four of which are from the Godman and Salvin collection. Four other specimens in Hewitson's collection.

29. *Delias funerea.*

Delias funerea, Rothschild, Novit. Zool. i. p. 662 (1894).
Delias Plateni, Staudinger, Iris, vii. p. 355 (1894).

Gilolo.

In some respects this species resembles *D. timorensis*, but it is more nearly related to *D. duris*, from which it differs in the white under surface of primaries, with whitish subapical spots on a black area; the secondaries below are also quite black, with the scarlet markings more vivid than in *D. duris*.

30. *Delias duris.*

Pieris duris, Hewitson, Exot. Butt. ii., *Pier.* pl. v. fig. 34 (1861).

Ceram. Type coll. Hewitson.

Intermediate between the preceding species and *D. cœneus*.

31. *Delias cæneus.*

Papilio cæneus, Linnæus, Mus. Lud. Ulr. p. 271 (1764).
Papilio plexaris, Donovan, Ins. New Holland, pl. xviii. fig. 2 (1805).
Cathæmia anthyparete, Hübner, Verz. bek. Schmett. p. 92 (1816).
Pieris philyra, Godart, Enc. Méth. ix. p. 150 (1819).

Amboina, Ceram. B. M.

Nineteen examples, of which nine are from the Godman and Salvin collection.

32. *Delias philotis.*

Thyca philotis, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 357, pl. viii. fig. 4 (1867).

Bourou. Types coll. Hewitson.

Hewitson united this species to *D. cæneus*, from which it may be readily distinguished by the oblique inner edge of the blackish area of primaries on the underside, leaving a large white patch from median vein to inner margin.

33. *Delias argenthona.*

Papilio argenthona, Fabricius, Ent. Syst. iii. 1, p. 200 (1793).
♀. *Pieris protocharis*, Boisduval, Sp. Gén. Lép. i. p. 457 (1836).

Queensland, Port Denison, Richmond River, Moreton Bay. B. M.

Fourteen examples, eight of which are from the Godman and Salvin collection. The Hewitson collection contains six specimens.

The specimen figured by me as *Delias fragalactea* (Lep. Exot. pl. xxiv. fig. 7) is only a small example of this species; the white spot at end of discoidal cell in primaries on the under surface is frequently confluent with the white of the ground-colour in this species, and therefore cannot be regarded as one of the distinguishing characters of *D. fragalactea.*

34. *Delias fragalactea.*

Thyca fragalactea, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. iv. p. 243 (1869), but not of Lep. Exot.

N. Australia. Two examples. Type B. M.

It is possible that this may eventually be linked to *D. argenthona*; but the greater depth of the pale basal area on the under surface of the secondaries, which encloses the red spot and extends to the end of the cell, as also the heavier black bordering of these wings on the upper surface, readily distinguish it at present from that species. Apparently the hind wings are comparatively longer than in *D. argenthona*, there

being little, if any, difference in the width of the black area preceding the scarlet spots; but this is due to the latter being less elongated than usual.

35. *Delias peribœa.*

Pieris peribœa, Godart, Enc. Méth. ix. p. 154 (1819).
Delias Wallacei, Rothschild, Iris, v. p. 441, pl. v. fig. 2 (1892).

Three female examples. Java, from Godman and Salvin collection.

The absence of the scarlet spot at the end of the cell, upon which Mr. Rothschild relied, proves to be an unstable character; indeed, it is not really scarlet, but orange in the female, and in one of our specimens it is indistinct.

36. *Delias Schönbergi.*

Delias Schönbergi, Rothschild, Novit. Zool. ii. p. 161, pl. viii. figs. 6, 7 (1895).

Bougainville Island, Solomon group.

This is one of the handsomest species of the *D. argenthona* group.

37. *Delias sambawana.*

Delias sambawana, Rothschild, Novit. Zool. i. p. 662 (1894); Smith & Kirby, Rhop. Exot. ii., *Del.* pl. vi. figs. 2, 3 (1895).

Sambawa Island. Three specimens, from the Godman and Salvin collection.

38. *Delias fasciata.*

Delias fasciata, Rothschild, Novit. Zool. i. p. 662 (1894); ♀, Smith & Kirby, Rhop. Exot. ii., *Del.* pl. vi. fig. 1 (1895).

Sumba.

The submarginal spots on the under surface are yellow splashed with red.

39. *Delias sthenobœa.*

Pieris sthenobœa, Boisduval, Sp. Gén. Lép. i. p. 466 (1836).

Moluccas.

Said to resemble *D. Descombesii*, but with the wings paler and no red patch at base of secondaries on the under surface; the submarginal spots are yellow.

40. *Delias Dohertyi.*

Delias Dohertyi, Rothschild, Novit. Zool. i. p. 661 (1894); Smith & Kirby, Rhop. Exot. ii., *Del.* pl. vi. figs. 7, 8 (1895).

Timor.

It is a curious thing that in the same year when the above was described M. Oberthür described a *Pieris Dohertyi* from New Guinea. The latter, however, appears to me to be allied to *P. ornytion* of Godman and Salvin, in which case it is not a *Delias* (although *P. ornytion* has erroneously been referred to this genus by von Mitis).

41. *Delias bagoe.*

Pieris bagoe, Boisduval, Voy. de l'Astr., Lép. p. 49 (1832).
Pieris eurygania, Godman & Salvin, P. Z. S. 1878, p. 734.

New Ireland. Seven examples. B. M.
Five of the specimens, including the types of *P. eurygania*, are from the Godman and Salvin collection.

42. *Delias Salvini.*

Delias Salvini, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. ix. p. 153 (1882).

New Britain. Type, B. M.

43. *Delias echo.*

Thyca echo, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 358, pl. viii. fig. 3 (1867).

Bourou. Types, coll. Hewitson.
Allied to the following, but very distinct.

44. *Delias isse.*

Papilio isse, Cramer, Pap. Exot. i. pl. lv. E, F (1779).

Amboina and Ceram. Sixteen examples. B. M.
Ten of the specimens are from the Godman and Salvin collection. The Hewitson series consists of four specimens.

45. *Delias Ribbei.*

Delias Ribbei, Röber, Iris, i. p. 46, pl. ii. figs. 3, 4 (1886).

Aru Islands.
Also allied to *D. isse.*

46. *Delias candida.*

♂. *Pieris candida*, Vollenhoven, Mon. Pier. p. 11, pl. iii. fig. 2 (1865).
♀. *Pieris herodias*, Vollenhoven, *l. c.*

Batchian, four specimens from Godman and Salvin collection.

47. *Delias chrysomelæna.*

Pieris chrysomelæna, Vollenhoven, Tijd. Ent. ser. 2, vol. i. p. 57, pl. i. figs. 1, 2 (1866).

Batchian, three specimens from Godman and Salvin collection.

The female above resembles that of *D. candida*.

48. *Delias echidna.*

Pieris echidna, Hewitson, Exot. Butt. ii., *Pier.* pl. v. figs. 35, 36 (1861).

Ceram. Type, coll. Hewitson.

49. *Delias dorylæa.*

♀. *Pieris dorylæa*, Felder, Reise der Nov., Lep. ii. p. 182 (1865); ? Mitis, Iris, vi. pl. iii. fig. 2.

♂. *Thyca hippodamia*, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 359, pl. viii. fig. 1 (1867).

Aru. ♂, Wallace's type, coll. Hewitson.

50. *Delias dorimene.*

Papilio dorimene, Cramer, Pap. Exot. iv. pl. cccl.xxxvii. C, D (1782).
Papilio fuliginosus, Gmelin, Syst. Nat. i. 5, p. 2261 (1788–91).
Pieris ageleis, Godart, Enc. Méth. ix. p. 147 (1819).

Amboina and Ceram. Fourteen examples. B. M.

Eight of the specimens are from the Godman and Salvin collection; there are also four others in the Hewitson collection.

51. *Delias altivaga.*

Delias altivaga, Frühstorfer, Ent. Nachr. xix. p. 333 (1893); Stett. ent. Zeit. lv. p. 121, pl. iv. fig. 8 (1894).

Java.

Nearly allied to *D. geraldina* and *D. gabia*.

52. *Delias geraldina.*

Delias geraldina, Grose Smith, Novit. Zool. i. p. 535 (1894); Rhop. Exot. ii., *Del.* pl. v. figs. 1–3 (1895).

New Guinea.

53. *Delias gabia.*

♂. *Pieris gabia*, Boisduval, Voy. de l'Astr., Lép. p. 49 (1832).

New Guinea. Male, B. M.

54. *Delias Kuhni.*

Delias Kuhni, Honrath, Berl. ent. Zeit. p. 205, pl. vi. fig. 2 (1886).
Var. *Delias sulana*, Staudinger, Iris, vii. p. 354 (1894).

Male, Bangkai, Celebes, from Godman and Salvin collection.
Near to *D. themis*; primaries below black; secondaries with about three bright yellow submarginal spots.

55. *Delias themis.*

Pieris themis, Hewitson, Exot. Butt. ii., *Pier.* pl. v. figs. 31, 32 (1861).

S.E. Mindanao, Philippines. Two pairs. B. M.
Three of the specimens are from the Godman and Salvin collection.

56. *Delias singhapura.*

Thyca singhapura, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 353, pl. vii. fig. 2 (1867).

Sandakan, Labuan, Sarawak. Four males. B. M.
Two of the specimens are from the Godman and Salvin collection. In Hewitson's collection there are three males and a female (including Wallace's types).

57. *Delias agoranis.*

Delias agoranis, Grose Smith, Ann. & Mag. Nat. Hist. ser. 5, vol. xx. p. 266 (1887); Rhop. Exot., *Del.* pl. i. figs. 7, 8.

Mergui. Three males. B. M.

58. *Delias cathara.*

Delias cathara, Grose Smith, Ann. & Mag. Nat. Hist. ser. 6, vol. xii. p. 34 (1893); Rhop. Exot. ii., *Del.* pl. v. figs. 7, 8 (1895).

Kina Balu, N. Borneo.
Allied to *D. singhapura* and to the following species.

59. *Delias baracasa.*

Delias baracasa, Semper; Reis. Phil. ii. v. p. 230, pl. xxxiv. fig. 2 (1890).

S.E. Mindanao.
Von Mitis says that this "is most certainly nothing more than an aberration of *D. mindanaënsis*, in which the whole of the marginal spots on the under surface of the hind wings have become white." If this is correct, *D. cathara* must be a parallel form of *D. hyparete*; but, to my mind, there is no certainty in the matter. Both insects are considerably smaller than the red-spotted species, and fall naturally into the *D. singhapura* group.

60. *Delias danala.*

Delias danala, De Nicéville, Journ. Bom. Soc. viii. p. 51, pl. l. fig. 9 (1893).
Delias karo, Hagen, Iris, vii. p. 33, pl. i. fig. 4 (1894).

Sumatra.
Allied to *D. baracasa* and distantly related to *D. agostina*.

61. *Delias enniana.*

♂. *Pieris enniana*, Oberthür, Ann. Mus. Civ. Genova, xv. p. 481, pl. iv. fig. 3 (1879–80).
♀. *Thyca ennia*, part., Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 355, pl. vii. fig. 4, ♀ (1867).
Delias dorothea ♀, Mitis, Iris, vi. p. 146, pl. iii. fig. 4 (1893).

Male, Waigiou, from Godman and Salvin collection.
Wallace's type of the female is in the Hewitson collection.

62. *Delias dice.*

♀. *Pieris dice*, Vollenhoven, Mon. Pier. p. 39, pl. iv. fig. 7 (1865).

New Guinea.
Allied to the preceding species.

63. *Delias nigidius.*

♀. *Delias nigidius*, Miskin, Trans. Ent. Soc. 1884, p. 93; Grose Smith & Kirby, Rhop. Exot. ii. p. 9, *Del.* pl. iii. figs. 3, 4 (1893).
♂. *Pieris jobiana*, Oberthür, Etudes d'Ent. xix. p. 7, pl. ii. fig. 6 (1894).

Port Moresby. Three males from the Godman and Salvin collection.

64. *Delias ennia.*

♂. *Thyca ennia*, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 355, pl. vii. fig. 4, ♂ (1867).
♀. *Delias dorothea* ♂, Mitis, Iris, vi. p. 146, pl. iii. fig. 3 (1893).

Waigiou. Type in coll. Hewitson.

65. *Delias georgiana.*

Delias georgiana, Grose Smith, Ann. & Mag. Nat. Hist. ser. 6, vol. xv. p. 228 (1895).

Two males and two females, New Britain. Five examples from the Godman and Salvin collection.

This must not be confounded with *D. georgina* of Felder, to which it is in no respect nearly related.

66. *Delias vishnu.*

♂. *Pieris vishnu*, Moore, Cat. Lep. E. I. Comp. i. p. 83, pl. 2 *a*, fig. 5 (1857).

Male, Java. Type, B. M.

Also a very large male and ordinary female, said to be from Timor, in the Hewitson collection.

67. *Delias timorensis.*

♂. *Pieris timorensis*, Boisduval, Sp. Gén. Lép. i. p. 459 (1836); Butler, P. Z. S. 1883, p. 368, pl. xxxviii. fig. 6.

Two males, Larat, Timor-laut, and Tenimber. B. M.

The Tenimber specimens are from the Godman and Salvin collection.

68. *Delias aruensis.*

Delias aruensis, Mitis, Iris, vi. p. 110 (1893).

Thyca bagoe, Wallace (not Boisd.), Trans. Ent. Soc. Lond. iii. vol. iv. p. 355, pl. vii. figs. 3, 3 *a* (1867).

Male and female, Aru. Types in coll. Hewitson.

69. *Delias pœcilea.*

Pieris pœcilea, Vollenhoven, Mon. Pier. p. 13, pl. iii. fig. 3 (1865).

Batchian. Three males, from Godman and Salvin collection.

70. *Delias sacha.*

Delias sacha, Grose Smith, Novit. Zool. ii. p. 75 (1895).

Obi Island.

Possibly more nearly allied to *D. candida*, but I have not seen the species.

71. *Delias euphemia.*

Delias euphemia, Grose Smith, Novit. Zool. i. p. 334, pl. xii. figs. 1, (1894).

Biak, N.E. New Guinea.

Allied to *D. lara* and *D. mysis.*

72. *Delias mysis.*

Papilio mysis, Fabricius, Syst. Ent. p. 475 (1775); Donovan, Ins. New Holl. pl. xxi. fig. 1 (1805).

Queensland, Rockingham Bay, Cape Bowen. Eight examples. B. M.

One male is from the Godman and Salvin collection. In the Hewitson collection there are two others.

73. *Delias æstiva*, sp. n.?

Possibly only a dry-season form of the preceding, but little or nothing appears to be known regarding the seasonal changes in this genus: it differs from *D. mysis* in its generally inferior size, narrower black apical border of primaries continued as a slender line to the external angle; the yellow on the under surface of the secondaries is brighter, more restricted, and more sharply defined, and the scarlet stripe is considerably narrower, more as in *D. timorensis*.

Expanse of wings, ♂ 60–70, ♀ 60 millim.

Port Darwin and Port Essington. Five examples. B. M.

One male was in the Godman and Salvin collection.

74. *Delias cruentata*.

Pieris cruentata, Butler, P. Z. S. 1865, p. 455, pl. xxvi. fig. 2.

Male (type), Mysol; male, Waigiou (coll. G. & S.). B. M.

75. *Delias lara*.

Pieris lara, Boisduval, Sp. Gén. Lép. i. p. 461 (1836).
Var. *Delias intermedia*, Mitis, Iris, vi. p. 149 (1893).

Two males and one female, Port Moresby; male, var. *intermedia*, Port Moresby. B. M.

Seven specimens, all from the Godman and Salvin collection. I am inclined to think that *D. intermedia* will prove to be the dry-season form of this species and *D. cruentata* a nearly allied species; on the other hand, the latter may prove to be the dry-season form and *D. intermedia* a form occurring at the change of the seasons. At present, however, we have no data to go upon.

76. *Delias agostina*.

Pieris agostina, Hewitson, Exot. Butt. i., *Pier.* pl. i. figs. 1, 2 (1852).

Darjiling, Nepal, Assam, East Pegu. Eighteen examples. B. M.

Thirteen of the specimens are from the Godman and Salvin collection. In the Hewitson collection are seven other specimens.

The following species is so remarkably variable that it has been split up into numerous named forms. In my opinion the Indian and Chinese forms represent modifications of one widely distributed species, the Indian variations ranging from almost white to almost black, the Chinese varying less

in ground-colour but with the markings more or less run together into streaks. The *D. Horsfieldii* form occurs both in India and China, as also does typical *D. belladonna*. The more or less development of yellow patches on the upper surface of the secondaries is certainly an unreliable character and not of specific value; otherwise both *D. ithiela* and *D. patrua* would have claims to separation. I shall consider this species under its varieties.

77. *Delias belladonna*.

Papilio belladonna, Fabricius, Ent. Syst. iii. 1, p. 180 (1793); Donovan, Nat. Rep. i. pl. xxxv. (1823).
Var. *Pieris Horsfieldii*, Gray, Zool. Miscell. p. 32 (1831); Herrich-Schäffer, Ausl. Schmett. figs. 13, 14 (1850).
Var. *Pieris sanaca*, Moore, Cat. Lep. E. I. Comp. i. p. 79 (1857); P. Z. S. 1857, p. 103, pl. xliv. fig. 4.
Pieris chrysorrhœa, Vollenhoven, Mon. Pier. p. 6, pl. ii. fig. 4 (1865).
Var. *Thyca ithiela*, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. iv. p. 242 (1869); Lep. Exot. p. 62, pl. xxiv. fig. 1 (1871).
Var. *Thyca berinda*, Moore, P. Z. S. 1872, p. 566; Waterhouse, Aid, i. pl. xii. (1881).
Var. *Delias flavalba*, Marshall, P. Z. S. 1882, p. 759.
Var. *Delias Boylei*, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xv. p. 58 (1885).
Var. *Delias Hearsayi*, Butler, *l. c.*
Var. *Delias patrua*, Leech, Entom. xxiii. p. 46 (1890); Butt. China, pl. xxxvii. figs. 1, 2 (1893).
Var. *Delias lativitta*, Leech, Butt. China, pl. xxxv. fig. 1 (1893).
Var. *Delias adelma*, Mitis, Iris, vi. p. 130; Leech, *t. c.* pl. xxxvii. figs. 5, 6 (1893).
Var. *Delias subnubila*, Leech, *l. c.* figs. 7, 8 (1893).
Var. *Delias zelima*, Mitis, Iris, vi. p. 131 (1893).
Var. *Delias surya*, Mitis, *t. c.* p. 132 (1893).
Var. *Delias amarantha*, Mitis, *t. c.* p. 133, pl. ii. fig. 3 (1893).

Sixty-six specimens in B. M. and coll. Hewitson as follows:—

Var. 1. *D. flavalba*.

Darjiling. Three in B. M. Three (not labelled) in coll. Hewitson. Two of our specimens from the Godman and Salvin collection. One of Hewitson's examples is almost wholly white above, the white spots running completely together almost to the outer border, and therefore more aberrant than in the following:—

Var. 2. *D. lativitta*.

Ta-chien-lu, Moupin, Bernardmyo in Burma (*Leech*).
Not in the Museum series at present.

Var. 3. *D. sanaca*=*chrysorrhœa.*

Six specimens, including the type, in B. M. from Darjiling and Kulu, one of which is from the Godman and Salvin collection; also two without locality in coll. Hewitson.

Var. 4. *D. Hearsayi.*

Four specimens, Kulu, Landoor; type, Barrackpore, in B. M. Two of these from the Godman and Salvin collection. The type has the basal spot orange, doubtless from discoloration.

Var. 5. *D. Boylei*=*amarantha.*

Four specimens: male (type), Darjiling; two males and one female, Sikhim.

The type of this species differs a little from the others, the whitish spots being less defined and streaky, the basal spot red instead of yellow, the anal patch dull saffron-yellow; the figure by von Mitis is very like it, but is from a slightly less discoloured example.

Var. 6. *D. subnubila.*

Moupin, Huang-mu-chang, and Pu-tsu-fong, Western China (*Leech*).

Var. 7. *D. belladonna* (typical).

Male, N.W. Himalayas; female, "Ind. orient." One pair only. B. M.

The female is an old and somewhat discoloured specimen, the yellow patches having become faded and reddish; it, however, agrees well in pattern with Donovan's figure. I believe the female figured by Leech (pl. xxxvii. fig. 4) should be referred to this variety, but the male (fig. 3) to *D. Horsfieldii.* However, it is of no great consequence, as all these forms grade into one another in a hopelessly inconsiderate manner.

Var. 8. *D. Horsfieldii*,=*surya* and *zelima.*

Thirteen examples varying in size, elongation of wing, and size of discal spots in secondaries; also five intergrades between this variety and the next. Kali valley, N.W. India; Kulu, Darjiling, Bhutan, Nepal, and Burma.

Of the eighteen examples, twelve were received from Messrs. Godman and Salvin, including all the connecting links between typical *D. Horsfieldii* and *D. ithiela.*

Var. 9. *D. ithiela* ♂, = *D. berinda* ♀.

Nineteen specimens from Darjiling (including the type), from the Khasia and Naga Hills and Assam; thirteen of these were received from Messrs. Godman and Salvin. Also one example in the Hewitson collection.

D. berinda agrees with our solitary female.

Var. 10. *D. adelma.*

Chang-Yang, Central China (*Leech*).

This form is even blacker than *D. ithiela*, the white discal spots being replaced by grey streaks; the yellow at anal angle and on abdominal area of secondaries has, however, reappeared.

Var. 11. *D. patrua.*

Chang-Yang, Central China (*Leech*).

Only differs from the preceding variety in the reduction of the yellow patch at base of secondaries above and of all the yellow markings below. It was most inconsistent on the part of my excellent friend Mr. Leech to regard it as a distinct species, and one of these days he will doubtless admit as much. It may be supposed that my present action is also inconsistent with that formerly taken by me; but this is not so. I have always followed the plan of regarding differently marked types, especially if they did not agree in form and had been received from different localities, as distinct species; but whenever I have obtained series of intergrades which proved their identity, I have at once admitted the impossibility of keeping them separate. A very small difference in pattern may be of specific value, but a mere variation in the size of spots between two specimens taken in the same locality is most unlikely to be of importance.

78. *Delias aglaia.*

Papilio aglaia, Linnæus, Syst. Nat. ed. x. p. 465 (1758).
Papilio pasithoe, Linnæus, Syst. Nat. ed. xii. p. 755 (1767); Donovan, Ins. China, pl. xxx. fig. 2 (1799).
Papilio dione, Drury, Ill. Exot. Ent. ii. pl. viii. figs. 3, 4 (1773).
Papilio porsenna, Cramer, Pap. Exot. i. pl. xliii. D, E (1776).

Darjiling, Assam, Silhet, Nepal, Tenasserim, Burma, China. Thirty-four examples. B. M.

Fifteen of the specimens were received from Messrs. Godman and Salvin; there are also four others in the Hewitson collection. This species varies a good deal as regards the amount of creamy yellow on the upper surface of the

secondaries; in some examples from Burma it almost fills the area included between the first and second median branches, leaving only four diffused spots between it and the costa; in others it is limited by the first median branch, leaving five diffused spots; but all kinds of links between the two types also occur.

79. *Delias parthenope.*

Thyca parthenope, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 347 (1867).
Thyca ninus, Wallace, *l. c.* pl. vii. fig. 1.

Elephant Island, Malacca, Borneo. B. M. Sumatra (G. & S. coll.).

The type from Malacca is in the Hewitson collection mixed with the preceding species.

80. *Delias pandecta.*

Delias pandecta, Staudinger, Iris, 1889, p. 23.

Two males and one female, Palawan. Four examples (Godman and Salvin coll.).

We have a female from Nias which resembles this species in colouring, but differs above in having the greyish-white macular belt on the upper surface of the primaries across the end of the cell, so that it touches the white spot. This may possibly be nearer to *D. aglaia*, but without the male it is impossible to decide.

81. *Delias pandemia.*

Thyca pandemia, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 346, pl. vi. figs. 4, 4 *a* (1869).

Palawan, Labuan, and Sarawak. B. M.

Fourteen examples, of which twelve are from the Godman and Salvin collection. Wallace's type is in the Hewitson collection.

82. *Delias henningia.*

Pontia henningia, Eschscholtz, Kotzeb. Reise, iii. p. 214, pl. ix. figs. 20 *a*, *b* (1821).
Var. *Thyca lucerna*, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. iv. p. 243 (1869); Lep. Exot. p. 62, pl. xxiv. figs. 2, 5 (1871).
Var. *Thyca ochreopicta*, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. iv. p. 244 (1869); Lep. Exot. p. 63, pl. xxiv. figs. 3 (♀), 4 (♂) (1871) *.

Twenty-six examples, of which fifteen are from the Godman and Salvin collection. They separate into the following forms :—

* I transposed the sexes of the two variations of this species.

1. *D. ochreopicta.*

Six examples. Luzon and Mindanao. (Three, G. & S. coll.)

2. *D. ochreopicta*, var.

Eight examples. Mindoro, Guimaras, Luzon. (Seven, G. & S. coll.)

In some respects much nearer to *D. lucerna* and *henningia.*

3. *D. henningia.*

Nine examples. "China," Mindoro, Manilla, Luzon. (Three, G. & S. coll.)

Barely distinct from the following.

4. *D. lucerna.*

Three examples. Philippines; no special locality noted. (Two, G. & S. coll.)

Chiefly differs from the preceding variety in the greater expanse of deep yellow on the secondaries.

Of the above forms *D. ochreopicta* is the best marked, inasmuch as it nearly approaches *D. pandemia* in both sexes, chiefly differing from it in the broad grey-and-white belt across the primaries. Hewitson's collection contains a male of var. 1, a pair of var. 3, and a female of var. 4.

83. *Delias ottonia.*

Delias ottonia, Semper, Reis. Phil. ii. v. p. 235, pl. xxxiv. figs. 7–9 (1890).

Davao and Mindanao (♂ ♀, coll. G. & S.; ♂, B. M.).

84. *Delias egialea.*

Papilio egialea, Cramer, Pap. Exot. ii. pl. clxxxix. D, E (1779).
Delias tyche and *apriata*, Hübner, Verz. bek. Schmett. p. 91 (1816).

Eight examples. Java (two from G. & S. coll.). B. M.
Two females in the Hewitson collection.

85. *Delias crithoe.*

Pieris crithoe, Boisduval, Guérin & Percheron, Gen. Ins. (1835); Vollenhoven, Mon. Pier. p. 7 (1865).

Java. One female, G. & S. coll.; three males, B. M.
A pair also in the Hewitson collection.

86. *Delias bromo*.

♂. *Delias bromo*, Fruhstorfer, Ent. Nachr. xix. p. 335 (1893).
♀. *Delias dymas*, De Nicéville, Journ. A. S. Beng. lxiii. pl. v. fig. 7 p. 44 (1894).

Java. ♂, B. M.

87. *Delias tobahana*.

♀. *Delias tobahana*, Rozenhofer, Verh. zool.-bot. Ges. Wien, xlii. p. 571 (1892).
♂. *Delias derceto*, De Nicéville, Journ. Bomb. Soc. viii. p. 51, pl. l. fig. 4 (1893).

Sumatra.
Not in the Museum series.

88. *Delias parthenia*.

Delias parthenia, Staudinger, Iris, v. p. 449 (1892).

Male, Kina Balu. B. M.

89. *Delias ninus*.

Thyca ninus, Wallace, Trans. Ent. Soc. Lond. ser. 3. vol. iv. p. 347 (1867).
Thyca parthenope, Wallace, *l. c.* pl. vi. figs. 5, 5 *a* (1867).

Penang. Two males. B. M.
The type (from Malacca) is in the Hewitson collection.

90. *Delias pyramus*.

Thyca pyramus, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 347 (1867).
Pieris thisbe, Gray, Lep. Ins. Nep. pl. vii. fig. 1 (1846).
Var. *Delias scandha*, Doherty, Journ. Asiat. Soc. Beng. vol. lv. 2, p. 262 (1886).

Darjiling, Nepal, Bhutan, East Pegu. Fourteen examples. B. M.

Nine of the specimens are from the Godman and Salvin collection. The Hewitson collection contains five others.

91. *Delias thysbe*.

♀. *Papilio thysbe*, Cramer, Pap. Exot. iii. pl. ccxxxiii. C (1782).
Pieris acalis, Godart, Enc. Méth. ix. p. 148 (1819).

China.

This species appears chiefly to differ from the female of *D. pyramus* in the grey colouring and heavy black border of the secondaries. I have never seen the species, and Mr. Leech's work on the butterflies of China does not include any of the species of *Delias* excepting *D. belladonna* and its varieties.

92. *Delias blanca.*

Pieris blanca, Felder, Wien. ent. Mon. vi. p. 284 (1862); Reise der Nov., Lep. ii. p. 160, pl. xxiv. figs. 6, 7 (1865).

Luzon.

93. *Delias orphne.*

Thyca orphne, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 361, pl. viii. fig. 2 (1867).

Malacca. Two examples, including the type in coll. Hewitson.

94. *Delias georgina.*

Pieris georgina, Felder, Wien. ent. Mon. v. p. 298 (1861); Reise der Nov., Lep. ii. p. 160, pl. xxiv. figs. 4, 5 (1865).

Luzon.

95. *Delias cinerascens.*

Delias cinerascens, Mitis, Iris, vi. p. 126, pl. ii. fig. 2, ♀ (1893).

Kina Balu.

96. *Delias simanabum.*

Delias simanabum, Hagen, Iris, vii. p. 34, pl. i. fig. 3 (1894).

Sumatra.

97. *Delias momea.*

Pieris momea, Boisduval, Sp. Gén. Lép. i. p. 477 (1836).
Delias Hageni, Rogenhofer, Verh. zool.-bot. Ges. Wien, xlii. p. 572 (1892).
Delias datames, De Nicéville, Journ. Bomb. Soc. viii. p. 53, pl. l. fig. 8 (1893).

Java. ♂, B. M.

A female example is in the Hewitson collection. Occurs also in Sumatra; but I fail to understand why de Nicéville considers *D. simanabum* to be the same species. It appears to me to be widely distinct, not even belonging to the same group of species.

98. *Delias nysa.*

Papilio nysa, Fabricius, Syst. Ent. p. 473 (1775).
♀. *Papilio eudora*, Donovan, Ins. New Holl. pl. xx. fig. 2 (1805).

Moreton Bay, Sydney, Queensland. Twelve examples. B. M.

Five specimens are from the Godman and Salvin collection. The Hewitson collection also contains five specimens.

The following species may or may not belong to this genus: I have never seen a specimen:—

99. *Delias? d'Albertisi.*

♂. *Pieris d'Albertisi*, Oberthür, Ann. Mus. Civ. Genova, xv. p. 480, pl. iv. fig. 4 (1879–80).
♀. *Delias discus*, Honrath, Berl. ent. Zeit. xxx. p. 130, pl. iv. fig. 4 (1882).

New Guinea.

A curiously coloured species, vaguely resembling *Tenaris* and *Dyctis*.

Since the completion of this Revision Mr. Grose Smith has described three additional species in the Ann. & Mag. Nat. Hist. for April, 1897, p. 403.

XIV.—*Notes from the Gatty Marine Laboratory, St. Andrews.* —No. XVIII. By Prof. M'Intosh, M.D., LL.D., F.R.S.

[Plate III.]

1. On the Phosphorescence of *Gattyana* (*Nychia*) *cirrosa*, Pallas.
2. On a new *Evarne* (*E. atlantica*) from Rockall.
3. On the British Species of *Pholoë*.
4. On a Collection of Annelids made by Canon Norman in Norway. —Part I. New *Evarne* and Two Species of *Sthenelais*.

1. *On the Phosphorescence of* Gattyana (Nychia) cirrosa, *Pallas.*

The alteration of the generic name of this not uncommon species, as Dr. Merle Norman has shown in a carefully prepared manuscript on the subject, which I have had the privilege of perusing, is necessary, since the name *Nychia*, given to it by Malmgren in 1865, had already been used by Stål for one of the Hemiptera.

G. cirrosa has long been known as a commensalistic Polynoid in the tubes of *Chætopterus*. Hitherto, however, the specimens of this annelid on the East Coast have chiefly been procured after storms or from deep water. Lately they have been frequently found as commensalistic forms in the tubes of *Amphitrite debilis*, Dalyell (*Johnstoni*, Mgrn.), and of comparatively large size. The fact that such species as *Polynoë scolopendrina*, habitually found in the tubes of *Terebellæ*, are phosphorescent suggested experiment in the present instance, with the result that *G. cirrosa* was also found to possess this property. Irritation in the dark causes the scales to gleam

with a pale yellowish light, often extremely faint, and thus in contrast with *Harmothoë imbricata* and *Polynoë scolopendrina*, in which the phosphorescence is more vivid. As a rule *Gattyana* occupies a position close to the mouth of the long tube of the *Amphitrite* beneath large stones near low-water mark, so that it is well protected from marauders, even supposing they were attracted by its light. In the same way its opportunities for alluring other animals are curtailed; so that the remarks formerly made in this connexion still hold.

2. *On a new* Evarne (E. atlantica) *from Rockall.*

A fragment of about fifteen segments of the anterior end was dredged at Station III. A by the Royal Irish Academy's expedition on 15th June, 1896.

The head resembles that of *E. impar*, Johnst., in general outline, but differs in having somewhat smaller eyes. The tentacles and palpi also are similar, though the cilia on the former and the minute papillæ on the latter are less bold. The cirri generally are a little more slender.

The body is thicker and more massive than in *E. impar* of the same size, and both dorsally and ventrally in the preparation has a pinkish skin-colour. The arrangement of the bristles at the side of the body is more trim. No nephridial papilla is observable, though the eminence is distinct. In this respect it agrees with *E. impar* of the same size, in which the papilla only becomes noticeable about the twelfth bristled foot. In large examples it is evident on the seventh bristled foot.

The first foot (bearing the tentacular cirri) has a few short bristles conforming to the dorsal type, though with somewhat closer rows of spines. In the second foot the dorsal bristles are longer and less curved than in *E. impar*, and while there may be room for doubt concerning the proportionate distances of the spinous rows, there can be none about the length of the smooth portion at the tip, which is diagnostic of this form and also of *Evarne Normani*. The present species differs from the latter again in the more tapering extremities of these bristles and in the closer rows of spines (*cf.* figs. 11 and 13, Pl. III.). The spinous tips of the ventral series are somewhat longer than in *E. impar*, and in this respect approach *E. Normani*.

In the typical foot the lower lobe is more pointed and the ventral cirrus longer than in *E. impar*, so that it projects as far as the tip of the foot. The translucent dorsal bristles (Pl. III. fig. 11) are considerably longer and less curved

than in the typical species and their rows of spines much closer, and the latter character also distinguishes them from *E. Normani*. The ventral bristles (Pl. III. fig. 12) approach those of the latter species more closely than those of *Evarne Johnstoni*, being somewhat shorter than those of *E. Normani*, which, again, have stronger tips than those of *E. Johnstoni*.

No scales are present. In all probability they approach those of *E. Normani*.

By the lengthening of the tips of the ventral bristles and their general slenderness this species and *E. Johnstoni* come near *Antinoë* and allied forms.

3. *On the British Species of* Pholoë.

To judge from the literature at present available, three species of *Pholoë* seem to be found in Britain, viz. *P. minuta*, Fabr., *P. inornata*, and *P. eximia*, G. Johnston. As indicated for many years, however, it would appear that the two latter merit only the position of varieties of the former.

In the typical British example the head is somewhat rounded and bears a subulate median tentacle with a few papillæ on its surface. Two (connate) eyes occur on each side, the anterior being the larger. Two short tentacular cirri, also with minute papillæ on the surface, are placed laterally. Two prominent papillæ project behind the eyes and sometimes overlap them. The palpi are rather massive tapering organs with a smooth surface. The body is small, composed of 45 to 70 segments, and reaching about $\frac{3}{4}$ inch in length as a maximum *. Posteriorly are two slender caudal styles. It is more tapering posteriorly than anteriorly in small specimens. The dorsum is slightly convex, the ventral surface flattened, with a median groove in the preparations. In life the dorsum is of a pale pinkish colour, grained with brownish on some of the scales. A reddish mark occurs in front with a dark greyish patch behind. As Dr. Johnston observes, some are of a yellowish-brown colour, dusky along the sides. The scales are ovate or reniform, with a series of cilia having moniliform tips along the outer border, and more sparsely along the posterior edge, while the tissue, especially at the inner region, is areolated. The dorsal lobe of the foot forms a prominent process, with a convex margin externally for the dense tuft of bristles, which are slender, tapering, and spinous. Ventral lobe an oblique cone, with numerous

* De Quatrefages mentions one of 68 segments and 45 pairs of scales.

papillæ over the surface. The stout shafts of the bristles have numerous spikes on the distal convexity. The terminal piece is short and falcate and the edge is spinous. The ventral cirrus is short and tapering.

The proboscis forms a short muscular organ, with teeth, as in the Sigalionidæ, biting to the left, and nine short but distinct papillæ along each arch. Moreover, in extrusion two papillæ are situated just behind the lateral furrow separating the dorsal and ventral arches. A median and two lateral elevations are also present in the basal region dorsally.

Thus far there are few divergencies; but when we come to the condition of the scales in the several races, such variations occur as have been thought worthy of specific distinction by several authors. Yet the gradations from the Arctic to the southern form appear to be of such a nature that it is deemed prudent to adhere to the decision already mentioned, viz. to make only one species.

In the variety *inornata* of Dr. George Johnston the first pair of scales are somewhat rounded, as if an isosceles triangle had its corners smoothly removed. The scar for the elytrophore is situated nearer the posterior than the anterior border. The latter has numerous short clavate cilia along its edge to the number of about 15, while the posterior margin has about 9 larger cilia, somewhat moniliform in outline—from constrictions. The surface of the scale anteriorly has also a row of cilia running within those on the border, and, besides, a few are scattered over the area in front of the scar. All the cilia have traces of palpocils at the tip. Only the inner border of the scale is thus smooth.

In contrast with the first scale of the typical *Pholoë minuta*, Fabr., from Greenland, the foregoing has fewer cilia. Thus there are upwards of 40 along the anterior border of the Arctic form and 12 proportionally shorter cilia than in the var. *inornata* along the posterior edge. Moreover, these organs are more numerous on the surface in front of the scar.

The shape in the second pair in var. *inornata* becomes transversely elongated, with an anterior incurvation. The moniliform cilia along the posterior edge are more numerous, while the smaller cilia on the outer edge are fewer, and the same may be said of those on the surface.

The succeeding scales are irregularly rounded and have a somewhat straight external border, which has moniliform cilia, while those along the posterior border are few and widely separated. The scale is areolated, especially towards its inner border, which, along with the anterior edge, is smooth.

In comparing the large broad anterior scales with those

from Greenland and Canada (*P. minuta*, Fabr.), comparatively little difference is observed, both having from 18 to 23 moniliform cilia externally.

The posterior scales in var. *inornata* become still more elongated transversely, have only about 6 of the larger moniliform cilia on the abbreviated external border as well as the posterior edge.

On the whole, therefore, the study of the scales supports the view that *P. minuta*, Fabr., and Dr. Johnston's *P. inornata* are the same species.

In the variety *eximia* of Dr. Johnston the first pair of scales are similar in shape to the foregoing, though from the smaller size of the examples they are considerably less. The outer border has a series of longer cilia, fewer in number, but similar in structure. They encroach somewhat on the anterior border, or, rather, a few of the isolated cilia scattered over the surface project beyond the edge. None of the smaller clavate cilia so characteristic of the two foregoing varieties are present on this edge. The large isolated cilia occur both externally and posteriorly to the scar for the elytrophore. The second pair of scales are distinguished by the greater length of the cilia on the outer border. A few also occur along the posterior edge.

The succeeding scales of the anterior third do not differ much in shape from those of *P. minuta*, but the cilia are much longer and stand stiffly out on the external margin and the outer half of the posterior edge. They are less numerous than in the large examples of *P. inornata*, but agree with the smaller in this respect. The posterior scales have about the same number of cilia as *P. inornata*, but they are stiffer and longer. *P. eximia* is distinguished externally from *P. inornata* in spirit by the olive spot with a pale centre in each scale at the scar for the elytrophore. Occasionally in certain forms of *eximia*, e. g. from Lochmaddy, North Uist, the cilia on the scales are fewer, longer, and without the terminal enlargement.

The second foot (first bristled) in *P. inornata* is bifid, with two well-developed spines. The dorsal lobe forms a rounded eminence with a smooth surface, from which project the comparatively short, slender, minutely spinous bristles, with a very fine hair-like tip. The inner forms taper more abruptly than the outer, and the tips are often bent nearly at right angles to the base. The ventral lobe is longer, bluntly conical, and with numerous small papillæ on its surface. The ventral bristles have stout shafts, dilated at the tip, and with numerous rows of spines on the convex margin, thus differing

from those of the Arctic examples, in which they are fewer. The falcate distal region forms an elongate process, hooked at the tip, and with a series of spines along the ventral edge. The corresponding bristles of *P. minuta* show a more robust and proportionally shorter tip.

In the typical foot the dorsal lobe presents a prominent process and a broad slightly convex margin externally for the bristles, the spine piercing the apex of the convexity. The bristles form a dense tuft directed outwards and downwards, are slender, tapering, and with well-marked spinous rows. The ventral lobe, again, forms an oblique cone, with the spine issuing from the apex and the surface covered with numerous papillæ. The shafts of the bristles are somewhat shorter and stouter than in the northern form (*P. minuta*), and the convex edge of the tip has more numerous spikes than in the latter form. The falcate tip in the Arctic examples is shorter, more curved—that is, the hook is more pronounced—and the spines along the edge are often absent. Posteriorly the dorsal bristles have finer spines and the ventral have fewer spikes on the convex distal region of the shaft, while the terminal falcate portion is proportionally longer and more slender. The papillæ on the surface of the ventral division are less numerous and somewhat longer. The ventral cirrus is short and tapering, with a few short clavate cilia on its surface.

In considering these several forms, therefore, it is clear that no reliable specific distinction can be drawn from the structure of the bristles, and this is probably more important than the condition of the cilia on the scales. It is true that the convexity of the end of the shaft is most spinous—that is, has a longer series of spines from above downwards—that the dorsal bristles are more distinctly spinous, and the ventral warts or papillæ more conspicuous in *P. inornata*; but the characters are not new and only vary in degree, and may be due to the surroundings, with which, perhaps, we are not fully acquainted. The steps from var. *eximia* to var. *inornata*, and thence to the typical *minuta*, are easy both as regards scales and bristles.

4. *On a Collection of Annelids made by Canon Norman in Norway.*—Part I. *New* Evarne *and Two Species of* Sthenelais.

Some years ago Dr. Merle Norman kindly sent for examination a series of Norwegian Annelids which he had procured in 1879 by dredging at the following localities, viz.:—

Stations 28 and 31.—Off Sponholmene, Lervig, 130 fath.
„ 29.—Ibid., 100 fath.
„ 30.—Lervig Bay, 3–25 fath.
„ 32.—Between Valeddin and Hidle, Lervig, 110 fath.
„ 33 and 34.—Off Lervig, 150–180 and 210 fath.
„ 36.—Off southern point, Huglin Island, Hardanger Fjord, 100 fath.
„ 37.—Off Hidle Island, Hardanger Fjord, 40–50 fath.
„ 38.—Off Sponholmene, Lervig, 40–100 fath.
„ 40.—Between Huglin and Halsenö, Hardanger Fjord, 120–190 fath.
„ 40**.—Ibid., 2 fath.
„ 41.—Stoksund, Hardanger Fjord, 80–100 fath.
„ 42.—Stoksund (mid-channel), Hardanger Fjord, 40–80 fath.
„ 44.—Off Drobäk, Christiania Fjord, 30–100 fath.
„ 45.—Dead *Lophohelia* ground, Drobäk, 6–14 fath.

The Norwegian fjords have long been classic grounds to the investigator of the Annelids, chiefly from the labours of the elder and younger Sars, but also of Hansen, Appellöf, and others; and accordingly the collection possessed great interest, especially by way of contrast with those of the British seas. Amongst other features of note is the comparative frequence of *Euphrosyne cirrata*, Sars, and *E. armadillo*, Sars, both of which seem to frequent the deeper water of the fjords, whereas the common British form is found most abundantly between tide-marks in the Channel Islands. Only small examples of *Aphrodita aculeata* and *Lætmatonice filicornis*, Kinberg, occur, probably because the area of the larger forms had been untouched. In the same way the small size of the specimens of the ubiquitous *Lepidonotus squamatus*, L., contrasted with the large tidal forms of the east coast of Scotland. No more characteristic inhabitants of the fjords could be procured than *Dasylepis asperrima*, Sars, and *Eucrante villosa*, Mgrn., both of which were in fine condition and apparently by no means rare. The former has hitherto been found in Britain only in the Clyde district (*Dr. David Robertson*), while the latter is unknown in our seas. The frequency of *Lagisca antennata*, Grube, and of the British *Evarne Johnstoni*, McI., merit notice, for the latter is one of the rarest forms from deep water in our country. Moreover, by the aid of additional specimens it became evident that another form procured along with the foregoing in the 'Porcupine' Expedition of 1870 merits special notice, if not specific distinction. In *Evarne Johnstoni*, McI. *, the eyes are distinctly smaller than in *E. impar*, Johnst., and the

* Trans. Zool. Soc. ix. p. 398.

anterior pair are usually so situated that they are invisible from the dorsum until the head is placed obliquely, whereas in *E. impar* both are visible from the dorsum. The deep brownish purple of the dorsum and the longer dorsal bristles are also diagnostic.

The form above mentioned, a fragment of which occurred with *E. Johnstoni* at 690 fathoms in the 'Porcupine' Expedition of 1870, is considerably larger and is distinguished by the very large eyes, both of which are conspicuous from the dorsum, and by the firm outwardly directed peaks in front. The dorsal bristles are longer and stronger, are less curved, more acutely pointed at the tip, and with a distinct bare portion, while the rows of spikes are narrow, all these characters differing from those of *E. Johnstoni*. The ventral bristles, again, have more robust shafts and longer spikes in the rows on the tips. That these characters are not due to age is clear by comparing specimens of the same size, the stronger dorsal bristles with their pointed tips being marked in the smallest example of the new form, on the bristles of which an elongated *Loxosoma* is common. We do not yet know the sexual changes in these forms, but, so far as observed in others, *e. g.* in *Evarne impar*, no such modifications of the eyes and bristles occur.

Only one of the specimens had scales, and unfortunately they had been dried. The surface is striolated with minute conical spines, which are best developed externally and posteriorly, and, moreover, there are moderately long cilia along the external and posterior border. The inner anterior edge is free from the spines or cilia. The scales thus closely resemble those of *E. Johnstoni*.

A comparatively frequent species in the collection is *Sthenelais limicola*, Ehlers, but this is a very widely distributed form. The size agrees with that of the British examples. Two additional species of *Sthenelais* appear to be fairly abundant, viz. *Sthenelais Sarsi**, from the Hardanger Fjord at depths varying from 40 to 190 fathoms. It is a comparatively small species, probably between 2 and 3 inches, rather less than *S. limicola*, but, like it, inhabiting mud or muddy sand.

The head is rounded, with a slender median tentacle arising anteriorly, shorter than in *S. limicola*, and with a ctenidium at each side of the basal region ("cerato phore," *Pruvot and Racovitza*). The eyes are prominent, the larger anterior pair rounded and looking forward, the posterior semicircular or

* Named after the late Prof. M. Sars of Christiania.

moon-shaped. They are smaller than those of *S. limicola*, and the pairs on each side nearer each other. The palpi are very long and slender. The first pair of feet and the parts amalgamated with them agree with the typical form.

The body is slender and elongated, tapering to the vent on the tip of the tail dorsally. The only complete example had about 80 bristled segments, and in spirit measured an inch and a half. The feet are prominent, but the nephridial eminence is indistinct and devoid of a papilla. The scales are thin, somewhat translucent, and entirely cover the dorsum —indeed, they overlap considerably. The first pair are small, ovate in outline, and have the margin surrounded by a series of short clavate cilia, while the surface is studded with small conical papillæ. The typical scale (Pl. III. fig. 5) is more or less reniform, and, with the exception of the anterior portion of the inner border and the anterior margin, the circumference has a close series of clavate cilia, which are largest on the external border and diminish before disappearing from the inner edge. The entire surface of the scale is dotted with the minute conical papillæ. Posteriorly the chief changes are the diminution in the size of the scale, its shorter and broader reniform outline, its greater translucency, the reduction in number and size of the cilia on the external and posterior border, and the paucity of the conical papillæ on the surface. The scales thus differ from those of known species.

The first foot has a single spine, and bears the dense tufts of bristles conforming to the dorsal type, but somewhat stronger than those of the typical foot. The second foot has curved dorsal bristles springing from a division a little less prominent than the ventral, and with several lobulated papillæ ("stylodes," *Pruvot and Racovitza*) at its tip, each bristled with stout clavate cilia. The ventral lobe is massive, with several blunt clavate papillæ. The upper bristles have numerous rows of spines on the convexity at the end of the shaft, and long, slender, six- or seven-jointed distal pieces with a minutely bifid tip, such bristles thus conforming to the inferior ventral series in the typical foot. The stronger bristles in the middle of the foot have distal pieces of two joints, while inferiorly the bristles again become slender and the terminal pieces longer, while the rows of spikes on the end of the shaft are fewer. The ventral cirrus is subulate and smooth. In the typical foot the dorsal curve bears three top-shaped ctenidia, and a group of clavate papillæ bristled with minute clavate cilia project from the tip of the dorsal division. The bristles are long, tapering, and slender, their tips extending beyond those of the inferior division. The ventral lobe like-

wise has several clavate papillæ similarly ciliated (Pl. III. fig. 1), and its bristles are characterized by their strength and the shortness of the terminal pieces. The shafts of the bristles, moreover, diminish in strength from above downwards, as seen by contrasting the second upper bristle (Pl. III. fig. 2) and the adjoining series (Pl. III. fig. 3) with that from the inferior series (Pl. III. fig. 4), those at the ventral edge being less than half the diameter of the upper. The rows of spikes on the distal convexity of the shafts likewise decrease in number from above downwards. The stout superior bristles have terminal pieces of two or three divisions and a well-marked claw and secondary process at the tip. Towards the inferior edge the terminal pieces lengthen, and three divisions are present, the tips of all being bifid.

The specimens, which were captured in July, were laden with large ova.

In his list of the Annelids of the "Osterfjorden" Dr. Appellöf * includes *Sthenelais atlantica*, McI.†; but this species, while approaching the Norwegian in regard to the scales, wholly diverges, for instance, in the minute structure of the bristles in the ventral division of the foot.

The other species—*Sthenelais heterochæta*—has a similar range in depth, viz. from 40 to 180 fathoms.

The head is somewhat rounded, with prominent lateral lobes separated by an *x*-shaped central region, eyeless in the preparations. The median tentacle arises from the anterior border, is proportionally larger and longer than in *Sthenelais limicola*, and ends in a filiform tip. The lateral tentacles are considerably shorter, but also have an attenuate tip. The superior tentacular cirrus is about the length of the median tentacle, but the ventral is considerably shorter. The ciliated process ("cuilleron," *Pruvot and Racovitza*) is tongue-shaped. The palpi are even longer and more tapered than in *S. limicola*. The first foot (having the foregoing processes) presents a prominent ctenidium dorsally.

The body is larger than in *S. limicola* and apparently longer, but no example is complete, though more than 100 segments are present in the most perfect, which wants a considerable portion of the tail. It is rounded dorsally, flattened ventrally, and is covered by the translucent scales and gently tapered towards the posterior end. A nephridial eminence is present, but no papilla. The proboscis has two oblique dorsal ridges starting from within outwards at the commencement of the distal fourth, and traces of similar

* Bergens Museum Aarbog, no. xiii. p. 10.

† Trans. Zool. Soc. ix. p. 405.

elevations ventrally. Eleven papillæ occur along its free edge in extrusion, and besides a pair at each lateral angle. The upper teeth bite to the left of the lower. The first pair of scales are rounded, the rest more or less reniform, the anterior four being more or less rounded (Pl. III. fig. 6). Their surface is smooth and they are thin. Along their external margin are ten or twelve long slightly tapered cilia, the shorter forms being anterior. In the posterior scales the cilia diminish to two or three, those left being near the anterior border. They may even disappear in the terminal scales.

The typical feet bear the branchial process superiorly and three top-shaped ctenidia along the upper edge. The dorsal lobe is somewhat clavate, bevelled at the tip superiorly, with three terminal and two adjacent papillæ (stylodes). The long dorsal bristles form a dense group, slender and finely tapered. They constitute a series of pencils, curved boldly upwards on each side. They are very finely serrated, as in *S. Jeffreysii*. The ventral division of the foot is somewhat conical at the tip and has two smooth papillæ—one springing from a broad process—near the point of the spine. The upper ventral bristles (Pl. III. fig. 7) are two or three in number, the distal end of the shaft having nine or ten rows of spines, and a terminal piece tapering to a hair-like point and possessing nearly a dozen pseudo-articulations. These tips are much shorter than the next in succession, which form a dense group of bristles with long shafts slightly enlarged at the end, and with a few (two or three) serrations in the upper examples, the rest being smooth. The tips are all very long (eighteen to twenty pseudo-articulations) and with a hair-like extremity. The next series possess a stronger and more distinctly curved shaft and a terminal piece of a single articulation, bifid at the tip and with a secondary piece, like a bird's beak (Pl. III. fig. 8). The terminal pieces increase in length inferiorly, the last showing an indication of a second articulation towards the tip. It is in this row that the greatest divergence is noticed when contrasted with the Irish form (*Sthenelais Jeffreysii*, McI.), since several in the latter present three distinct articulations in the terminal piece. A membranous flap and a long papilla mark the next series, which have similar shafts, but their tips are tapering articulated processes ending in a hair-like extremity as in *Leanira*. Each (Pl. III. fig. 9) has more than a dozen articulations. Lastly, from the special area ventrally spring a series with more slender shafts and five- to six-jointed terminal pieces ending in a minutely bifid tip (Pl. III. fig. 10). Internal to the subulate ventral cirrus is a top-shaped ctenidium.

This species closely approaches *Sthenelais Jeffreysii*, McI., but the marked characters of the bristles of the ventral division of the foot distinguish it, and once more demonstrate, what some are so slow to admit, the value of a careful study of these organs along with other characters. Step by step the differentiation is thus made clear. Dr. Appellöf probably refers to this species in the list before mentioned under the name *S. Jeffreysii*, and, indeed, it would have been difficult for him to distinguish them.

Euphrosyne cirrata, Sars. Stations 29, 33, 40, 41.
—— *armadillo*, Sars. Station 36.
Aphrodita aculeata, L.
Lætmotonice filicornis, Kbg.
Lepidonotus squamatus, L. Stations 30, 36.
Gattyana (*Nychia*) *cirrosa*, Pall. Station 32.
Dasylepis asperrima, Sars. Stations 29, 30, 45.
Lagisca floccosa, Sav. Station 45.
—— *antennata*, Grube. Stations 32, 36, 41.
Harmothoë imbricata, L. Station 40**.
Evarne impar, Johnst. Stations 30, 44, 45.
—— *Johnstoni*, McI. Stations 30, 32, 33, 34, 41, 44.
—— *Normani*, sp. n. Ibid.
Antinoë Sarsi, Kbg.
Eucrante villosa, Mgrn. Stations 33, 34, 44.
Sthenelais limicola, Ehlers. Stations 30, 44.
—— *Sarsi*, sp. n.
—— *heterochæta*, sp. n.
Leanira tetragona, Œrst.

EXPLANATION OF PLATE III.

Fig. 1. Papillæ with clavate cilia at the tip from the upper region of the ventral division of the foot of *Sthenelais Sarsi*, sp. n. × 350.
Fig. 2. Bristle of the upper ventral series of the same. × 350.
Fig. 3. Bristle of the adjoining series (immediately beneath). × 350.
Fig. 4. Bristle from the inferior ventral series of the same. × 350.
Fig. 5. Scale of the foregoing species. × 24.
Fig. 6. Anterior (and therefore more rounded) scale of *Sthenelais heterochæta*. × 24.
Fig. 7. Superior ventral bristle of the same. × 350.
Fig. 8. Median ventral bristle, with a single terminal segment. × 350.
Fig. 9. Bristle of the group following the former, and after the pattern of those in *Leanira*. × 350.
Fig. 10. More slender bifid bristle from the ventral edge. × 350.
Fig. 11. Dorsal bristle of *Evarne atlantica*, sp. n. × 350.
Fig. 12. Median (below spine) ventral bristle of the same. × 350.
Fig. 13. Tip of a dorsal bristle of *Evarne Normani*. × 350.

XV.—*On new Species of* Histeridæ, *and Notices of others.*

By G. Lewis, F.L.S.

I have lately received some very interesting species of Histeridæ from Cameroon, on the West-African coast, and also a very good collection made by Mr. Guy A. K. Marshall in South Africa. Mr. Marshall's collection was accompanied with notes on the habitats of his captures, which enable me to record, I believe for the first time, that the genus *Pachycrærus* consists of species attached to timber, as four or five species are registered as being found "under bark" and "in rotten logs." These species are doubtless entomophagous, but they are not, like the *Tryponæi*, specially suited for traversing very narrow or cylindrical passages. The habit also of *Paratropus* (*Phyllosoelis*) has been noticed by Mr. Marshall: the species seek their prey in fungi. The larger species of *Hister*—*H. validus*, Er., and *H. fortis*, Sch.—are associated with stercoraceous insects or feed on carrion. It will be observed also by the present paper that the genus *Pachycrærus* is partly made up of very curious species, with heads almost wholly excavated, and their bodies short and cylindrical; the insects are probably attached to wood-boring beetles, such as *Hylesinus*, F., or some tropical forms similar to *Spærotrypes*, Blandford, species with short elytra, which enables them to turn round in a very small space.

List of Species.

Phylloma hirtipes.
Anaglymma consobrina.
Pachycrærus striaticeps.
—— frater.
—— meridianus.
—— spatiosus.
—— cariniceps.
—— tenuistriatus.
—— cavifrons.
—— brevipennis.
—— sulcicollis.
—— mimicus.
Hister intrepidus.
Hister rivalis.
—— Marshalli.
—— latistrius, *Lew.*
—— rubricatus.
Coproxenus Marshalli.
—— opacipennis.
Paratropus fungorum.
Triballus agrestis, *Mars.*
Pygocœlis africanus.
—— duplicatus.
Trypobius pinguis.
—— æthiops.
—— cylindraceus.

Phylloma hirtipes, sp. n.

Oblongo-ovatum, complanatum, nigrum, nitidum; fronte impressa, tenuissime punctulata, obsolete bistriata; pronoto lateribus punctato, punctis aliquando confluentibus; abdomine segmentis 3–4 utrinque prominulis.

L. 8–8½ mill.

Oblong-ovate, very flat, black, shining; the head impressed anteriorly, with two very faint frontal striæ, surface faintly punctulate; the thorax arched at the sides, with a very fine marginal stria and a lateral border of clear but somewhat confluent punctures; the elytra with only one short stria visible at the base, which has an apical appendage of its own length; the propygidium with two apical impressions and sparsely encircled with large and small punctures; the pygidium is folded underneath and only the base is narrowly seen from above, smooth at the base, apex punctured transversely in the middle, and carinate on either edge before the apex; the fourth and fifth abdominal segments are swollen at their lateral edges, especially the fourth, which can be seen, when viewed from above, projecting beyond the propygidium; the prosternum widens out at the base in a hatchet-shaped outline, but the mesosternum can hardly be said to be sinuous; the anterior tibiæ are 3-dentate, and all the tarsi are hirsute beneath.

The abdominal segments in the above species project on a somewhat similar plan to those of *Trypeticus cinctipygus*, Mars.

Hab. Surinam (*Ellacombe*); Cayenne (*Deyrolle*).

Anaglymma consobrina, sp. n.

A. afræ persimilis, sed differt thorace sparse punctulato haud dense punctato-strigoso.

L. 3 mill.

This species is extremely like *A. afra*, Lew., but the differences above are that the head is clearly, not densely punctured, the punctures being round and clearly separate one from another, fairly thickly but not densely set; the thorax is somewhat sparsely punctured at the sides and but microscopically strigose, and on the disk the punctuation becomes evanescent; the fifth dorsal stria is apical, punctiform, and almost obsolete. In *A. afra*, Lew., the sculpture on the head and anterior area of the thorax is so dense that it gives the appearance of opacity. The pygidium in *A. consobrina* has larger punctures, which are therefore clearer and more distinct. Beneath, the anterior lobe of the prosternum in *A. consobrina* is very distinctly punctured, in *A. afra* the punctuation is somewhat obscure. I do not see any other differences; both species agree in size, colour, and dorsal striæ.

Hab. Cameroon.

Pachycrœrus striaticeps, sp. n.

Oblongo-ovalis, supra convexus, niger, nitidus; capite antice excavato, stria late sinuata; pronoto angulis anticis subfoveolatis; elytris striis 1–3 subhumeralique integris, 4 basi abbreviata, 5 apicali, suturali integra.
L. $3\frac{3}{4}$ mill.

Oblong-oval, convex above, black, shining; the head deeply excavated in front and on the epistoma; frontal stria very fine and widely sinuous, the sinuosity bending towards the neck, near the base of the head between the eyes is a second well-marked transverse stria, surface feebly and irregularly punctured, some points being small and others larger; the thorax, anterior angles subfoveolate and somewhat closely punctured, and the punctures on the disk are rather sparse and clearly composed of small and larger points, the lateral stria is sinuous and continued behind the neck; the elytra, striæ 1–3 and inner subhumeral complete, 4 rather fine and shortened before the base, 5 apical and nearly half the length of the fourth, sutural complete; the propygidium punctate (very similar to *P. cyanescens*, Er.); the pygidium with the punctures fine and more scattered; the prosternum has a microscopic strigose sculpture and a few punctures on the anterior lobe, the striæ start from the base and gradually meet anteriorly, there are a few punctures on the keel; the mesosternum, stria very fine and does not quite meet in front; the lateral striæ of the metasternum do not widen out like those of *P. cyanescens*; the anterior tibia has three rather large teeth coequal in size and one small at the base; the legs obscure reddish brown.

The species is rather more oblong in outline than *P. cyanescens*, Er., and *P. congonis*, Sch.

Note.—In *P. diversicollis*, Sch., and others, the frontal stria is carried in a semicircular form at the back of the head behind the eyes. In *P. striaticeps* the stria is straight and detached and lies *between* the eyes.

Hab. Cameroon.

Pachycrœrus frater, sp. n.

Cylindricus, subconvexus, nigro-piceus, nitidus; clypeo depresso, stria frontali integra; pronoto parum fortiter punctato; elytris, striis subhumerali, 1–5 dorsalibus, suturalique integris; prosterno bistriato, striis parallelis.
L. 3–$3\frac{1}{2}$ mill.

This species was taken by M. Raffray many years ago, and named *P. Bocandei* for me by Marseul and it stands in several collections under that name. But lately I have received the true *P. Bocandei*, Mars., from the Congo River and Senegal region and find that it differs from those taken by Raffray. *P. Bocandei*, Mars., has the clypeus deeply excavated, the thorax wider anteriorly and more coarsely punctate, but, above all, the prosternal striæ in *P. frater* are parallel to each other, while in *P. Bocandei* the striæ through the whole of their course incline towards each other. *P. Bocandei* also is the larger species and has the anterior thoracic angles more prominent.

Hab. Abyssinia and Zanzibar (*Raffray*).

Pachycrœrus meridianus, sp. n.

Oblongo-ovalis, parum cylindricus, niger, nitidus; capite stria antice interrupta; pronoto punctulato, parcis punctis intermixtis; elytris, striis 1–4 suturalique integris, 5 abbreviata; prosterno bistriato, striis haud conjunctis: mesosterno stria marginali integra, stria transversa crenulata.

L. $2\frac{1}{2}$ mill.

Oblong-oval, somewhat cylindrical, black, shining; the head not impressed or excavated, not closely punctulate, points varying in size, stria angulate at the eyes, but the transverse portion is wanting; the thorax evenly, not very closely punctate, with small points intermixed, the larger punctures are larger than those on the head, marginal stria ceases behind the neck; the elytra—striæ, external subhumeral very fine and complete, internal faint and dimidiate, 1–4 and sutural complete, 5 punctiform and extending just beyond the middle, near the apices are scattered punctures; the propygidium is sparsely punctured; the pygidium much more finely punctured; the prosternum bistriate, striæ diverging at the base, not joining anteriorly, but diverging very slightly; the mesosternum is irregularly punctured and the stria complete, and rather closely behind it is a very distinct transverse, crenulate, arched stria; it appears to be in front of the metasternal suture, which is only very faintly visible.

There is a superficial similarity between this species and *P. facetus*, Mars., but it is smaller, and the prosternal striæ and other characters serve easily to separate it.

Hab. Cameroon.

Pachycrærus spatiosus, sp. n.

Ovalis, parum depressus, niger, nitidus; elytris obscure æneo-nigris; capite impresso, stria integra; pronoto stria marginali late interrupta.
L. 4 mill.

Oval, rather depressed, black, shining, with the elytra feebly æneous; the head is rather narrower than in *P. cyanescens*, Er., but the form of the stria and the frontal impression are similar allowing for the width, the punctuation is slightly closer; the thorax is also like Erichson's species in punctuation and in the lateral stria ceasing behind the eye; the elytra, striæ 1–3 complete, 4–5 coequal, apical and about $\frac{1}{3}$ of elytral length, sutural very short, terminating anteriorly in a line with the fourth and fifth, subhumeral external dimidiate; the propygidium and pygidium are punctured somewhat similarly to *P. cyanescens*, but the punctures are of a slightly smaller grade and the segments are flatter; the prosternum is wide and the striæ are parallel to each other and terminate at the suture behind the anterior lobe; the keel is as wide again as that in *P. cyanescens*, and with the lobe is punctulate; the mesosternum, marginal stria complete, but very fine at the space behind the keel; the anterior tibiæ are somewhat slender and have three or four small teeth.

The species in some of its characters is intermediate between *P. cyanescens* and *P. latus*, Lew.

Hab. Cameroon.

Pachycrærus cariniceps, sp. n.

Oblongo-ovatus, parum convexus, obscure rufo-brunneus; capite punctulato, stria carinata; pronoto utrinque sinuato, stria laterali carinata, angulis anticis subfoveolatis; elytris, striis 1–4 et suturali completis, 5 apicali.
L. $2\frac{3}{4}$ mill.

Oblong-oval, rather convex above, obscure reddish brown, shining; the head obscurely and sparsely punctulate, frontal stria complete and cariniform, the carina is the least strong on the middle of the anterior edge, the clypeus is transversely concave at the base, with a strong ridge dividing the concave part from the anterior portion; the thorax subfoveolate at the anterior angle, distinctly sinuous laterally before the base, the lateral stria cariniform, carina strongest at the sinuosity, stria complete but fine and crenulate behind the head, surface somewhat sparsely and finely punctulate; the elytra—striæ,

subhumeral internal dimidiate, 1–4 complete, 5 apical, not quite reaching the middle, 6 complete and hamate near the scutellum; the propygidium clearly punctured; the pygidium much more finely punctured; the prosternum, lateral striæ gradually meet and join anteriorly; the mesosternum, stria complete and sinuous in front; the anterior tibiæ with three equidistant teeth and another smaller at the base.

In general outline this species is most similar to *P. facetus*, Mars.

Hab. Cameroon.

Pachycrœrus tenuistriatus, sp. n.

Cylindricus, supra æneus; capite haud excavato, stria fronte interrupta, ante oculos utrinque foveolato; pronoto stria antice interrupta, ante scutellum impresso; elytris, striis 1–3 integris, 4 brevi, 5 nulla, suturali ante basin abbreviata.

L. $2\frac{1}{4}$ mill.

Cylindrical, brassy above, black beneath, shining; the head not excavated nor impressed, microscopically punctured and strigose, stria angulate at the anterior edge of the eye, turning obliquely past a lobe-like fovea, and ceasing beyond it (*i. e.* the transverse portion of the stria is obliterated); the lateral stria continues round the base of the head in a line with the hinder edge of the eye, the anterior edge of the clypeus is transverse and clothed with brownish hairs (perhaps in one sex only); the thorax rather sparsely punctulate, punctures of various sizes, lateral stria ceases behind the eye, in front of the scutellum is an impression more or less semicircular, and near it a few punctures; the elytra—striæ, subhumeral external fine and complete, internal dimidiate, 1–3 complete (3 in one example only visible at the base), 4 short, basal and slightly oblique, sutural crenulate, straight and shortened before the base, the apices sparsely punctured; the propygidium clearly and sparsely punctured with a microscopic punctuation interspersed; the pygidium finely and sparsely punctulate; the prosternum microscopically strigose, with a few fine punctures, bistriate, striæ barely reaching the base and diverging from one another at both ends; the mesosternum sculptured like the prosternum, anterior edge without a stria, across near the base is a well-defined crenulate arched stria and beyond it the metasternal suture is faintly visible; the anterior tibiæ 4- or 5-dentate.

Hab. Cameroon.

Pachycrærus cavifrons, sp. n.

Cylindricus, brevis, viridi-æneus, nitidus; capite antice clypeoque profunde excavatis: pronoto stria marginali antice interrupta; elytris, striis 1 basali dimidiata, 2–3 brevibus, suturali apice abbreviata; prosterno angustato, bicarinato; mesosterno utrinque striato; tibiis anticis 9-dentatis.

L. $2\frac{2}{3}$ mill.

Cylindrical, short, truncate anteriorly, brassy green, shining; the head in front of the eyes and epistoma widely and deeply excavated, base of the excavation vertical; the epistoma is wide and transverse, with anterior edge sinuous, mandibles large, with outer edges raised, frontal stria obsolete, surface microscopically strigose, with small and larger punctures interspersed; eyes large and transverse; the thorax sculptured like the head, wider than long, lateral stria ceases at the anterior angle, which is somewhat impressed and angular; the elytra—striæ, external subhumeral complete, internal dimidiate, 1 dorsal, basal, and dimidiate, 2 basal, half length of first, 3 basal and very short, sutural commences near the middle of the dorsum and nearly touches the base, and for half its length turns a little away from the suture; the propygidium and pygidium are sculptured like the head; the prosternum, anterior lobe is large and transverse, the keel short, narrow, and straight, and built up from its base, its narrowness brings the anterior coxæ into proximity; the edges of the keel are carinate, the carinæ exactly parallel to one another; the mesosternum is rather wide and the acumination robust, striate at the sides only; all the sternal plates are sculptured like the head; the anterior tibiæ have nine coequal and equidistant teeth, the thighs are reddish, tibiæ obscurely reddish brown.

This remarkable species has the superficies of a species of *Teretriosoma*, but I see no reason for not assigning it to the genus *Pachycrærus*.

Hab. Cameroon.

Pachycrærus brevipennis, sp. n.

Cylindricus, parum elongatus, supra niger, nitidus, subtus obscure rufo-brunneus, undique punctulatus; capite antice clypeoque profunde excavatis; pronoto stria marginali antice interrupta; elytris striis basalibus 1–3 abbreviatis, 4 brevissima, suturali pone medium abbreviata; prosterno antice arcuato, margine laterali carinato; tibiis anticis 6–7-dentatis.

L. 2 mill.

Cylindrical, rather elongate, black above, beneath rather

dark reddish brown, wholly punctured above and below; the head in front of the eyes and epistoma widely and deeply excavated, the base of the excavation is vertical, epistoma transverse, with anterior rim raised, frontal ridge at posterior limit of the excavation emarginate in the middle; the thorax nearly as broad as long, lateral rim raised and continued as a stria along the base; anteriorly there is no marginal stria; the elytra are not quite so long as the thorax (best seen in a side view)—striæ, subhumeral external complete, internal dimidiate, 1–3 short and basal, each about a third of the elytral length, and posteriorly breaking up into punctures, 4 very short, 5 wanting, sutural longer than the first, all the striæ are transversely connected at the base; the prosternum, anterior lobe very wide, clearly punctured, and microscopically strigose, keel narrow, but relatively less so than that in *P. cavifrons*, with two lateral carinæ straight and parallel, interstice punctate; the mesosternum is arch-shaped, the shape is rendered conspicuous by the marginal stria being complete and cariniform; metasternal suture well-marked and straight; the anterior tibiæ are 6- (or 7-) dentate.

I see no reason at present why this curious species should not also be included in *Pachycrœrus*. In outline it resembles a small species of *Cis*.

Hab. Cameroon.

Pachycrœrus sulcicollis, sp. n.

Oblongus, parallelus, depressus, niger, nitidus; capite concavo, stria valida antice recta; pronoto utrinque sulcato, stria antice et postice integra; elytris striis subhumerali externa et 1–6 integris; propygidio postice prominulo.

L. $3\frac{3}{4}$ mill.

Oblong, parallel, depressed, black, shining; the head, face concave, surface rather uneven, with various-sized punctures, stria complete, cariniform, and straight anteriorly; the thorax wider than long, densely sculptured, surface minutely rugose with large, irregular, and sometimes confluent punctures, mixed with small points; the lateral edge is carinate and continued as a stria behind the head, but the stria is almost obliterated by the rough surface-sculpture; the stria is also continued round the base of the thorax in a rough crenulate form, within the lateral carina the thorax is sulcate, sulcus widest near the middle; the elytra—striæ, external subhumeral complete, internal wanting, 1–6 all complete, the sutural and fifth joining at the base; the propygidium is remarkable, it is irregularly punctured, chiefly at the base,

and the posterior edge is thickened and somewhat overhangs the pygidium, the latter punctate; the prosternum is narrow and bistriate, striæ parallel until they join in front just before the suture; the mesosternum, acumination minute, stria well-marked and slightly bent in front, surface (and also that of the metasternum) punctulate; the anterior tibiæ 5-dentate.

This is another very remarkable species, but evidently a species of *Pachycrærus*.

Hab. Cameroon.

Pachycrærus mimicus, sp. n.

Oblongus, parallelus, subcylindricus, rufo-brunneus, nitidus; capite excavato, stria integra; thorace quadrato, punctulato, stria integra, ante scutellum foveolato; elytris, striis subhumerali, 1–4 et suturali integris, 5 dimidiata; prosterno bistriato, striis anticis et posticis conjunctis.

L. $3\frac{1}{2}$ mill.

Oblong, parallel, subcylindrical, reddish brown, shining; the head, face excavated as in the last species, surface with various-sized punctures, not closely set, stria complete, straight anteriorly, and continuing along the base of the head, clypeus pointed in front; the thorax quadrate, with an antescutellar fovea, lateral stria complete and continued finely in front, surface somewhat closely and a little irregularly punctured; the elytra—striæ, subhumeral external complete, internal very short and basal, 1–4 and sutural complete, 5 dimidiate, the sutural at the base turns away from the scutellum; the propygidium and pygidium are punctured like the thorax and the latter is convex above; the prosternum, keel narrow and straight, widening out only at the base, the striæ join at the base and in front, at the base they widen out a little, anteriorly they run nearly parallel until they join before the suture; the mesosternum is feebly produced in front and rounded off in the middle, sinuate on either side, the stria is fine and continues round the anterior angles, and is then lost in two transverse impressions which are seen on the anterior edge on either side; all the sternal plates are punctulate; the tibiæ, anterior pair 4-dentate.

Superficially this species resembles one of the cylindrical *Platysomæ*.

Hab. Cameroon.

Hister intrepidus, sp. n.

Oblongo-ovatus, convexiusculus, niger, nitidus; fronte lævi, stria integra antice recta; pronoto ciliato, stria interna parallela, antice

haud interrupta ; elytris, striis 1–3 integris, suturali basi abbreviata; propygidio pygidioque tenuissime punctulatis; mesosterno late sinuato, marginato.
L. $10\frac{1}{2}$ mill.

Oblong-oval, rather convex, black, shining; the head smooth, stria complete, straight anteriorly, not deeply impressed; the thorax ciliate on the outer edges, lateral striæ complete and parallel to each other, inner stria continued behind the neck and feebly angulate behind eyes; the elytra, striæ 1–3 and the inner subhumeral complete, 4 and 5 absent, sutural rather fine, not quite reaching the apex and shortened anteriorly by one third of the elytral length; the propygidium and pygidium are very finely punctulate and somewhat opaque, apical margin of the latter is smooth and without a margin; the mesosternum is somewhat widely sinuous, stria rather fine and complete; the anterior tibiæ have three robust teeth.

This species belongs to Marseul's first section; it is smaller, but in some respects similar to *H. fortis*, Sch. The latter species is remarkable in having the thoracic stria interrupted behind the neck.

Hab. Natal (*Marshall*).

Hister rivalis, sp. n.

Oblongo-ovatus, supra convexus, niger, nitidus ; fronte punctulata, stria integra antice recta ; pronoto, striis lateralibus integris interstitiis latis, tenuissime punctulato ; elytris, striis 1–4 integris, latis, crenulatis, 5 in medio, suturali ante abbreviatis ; propygidio pygidioque grosse punctatis ; prosterno haud striato ; mesosterno late sinuato, stria integra antice recta.
L. 9 mill.

The species is larger than, but in form similar to, *H. longicollis*, Mars., and differs in having the interstices between the lateral thoracic striæ more than as wide again, in being without the thoracic punctures and scratches, in the wider elytral striæ, in the middle of the propygidium being longitudinally feebly raised, and in the anterior edge of the mesosternum being widely and distinctly sinuous. In other respects it agrees with *H. longicollis*, a common species at the Cape of Good Hope and Natal.

Hab. Lukolela, Congo River (*A. J. Clark*).

Hister Marshalli, sp. n.

Breviter ovalis, convexus, niger, nitidus ; fronte punctulata, stria carinata antice recta ; pronoto lateralibus conspicue punctato,

bistriato et margine elevato; elytris, striis 1–3 et subhumerali integris, 4 dimidiata, 5 subobsoleta, suturali utrinque abbreviata; propygidio pygidioque dense punctatis.

L. 4½–5 mill.

Shortly oval, convex above, black, shining; the head wholly but irregularly punctured, stria complete, cariniform, and straight anteriorly, with two somewhat feeble impressions behind the stria; the apex of the epistoma is transverse and the anterior edge is reflexed; the thorax narrowest at the anterior angles, then widening to the base, anterior angles depressed and somewhat produced, the external lateral edge is narrowly carinate and within it are two complete cariniform striæ; the interstice between the marginal rim and the outer carinate stria is of the same breadth as that between the outer and inner carinate stria, the interstices mentioned are irregularly punctured; the innermost lateral stria is continued (somewhat finely and crenulate) behind the neck, the one next the outer rim terminates behind the eye, the lateral margins within the striæ are broadly strigose-punctate, somewhat resembling the sculpture seen in *H. longicollis*, Mars., but less strigose, the punctures spread out along the anterior margin, but almost disappear behind the middle of the neck; the elytra, striæ 1–4 and inner subhumeral equally complete and distinct and very obscurely crenulate, the internal subhumeral at its base turns towards the first dorsal stria, the fourth stria is apical and scarcely reaches the middle (it is broken and punctiform), the fifth is similar but more feeble, the sutural is fine, shortened before the apex, and extends a little only beyond the middle of the dorsum; the propygidium is somewhat closely and clearly punctured, punctures mostly oval; the pygidium punctures less oval and more dense.

This peculiar species may be placed near *H. longicollis*, Mars.

Hab. Gadzima (alt. 4200 feet) and Salisbury (5000 feet), in Mashonaland (*Marshall*). Found in dung.

Hister latistrius, Lew.

Hister latistrius, Lewis, Ent. Month. Mag. (2) ii. p. 106 (1891)

This remarkable species is more circular in outline and flatter than *H. cœnosus*, Er.; the prosternum is without striæ, irregularly punctured with a microscopic strigose sculpture, and the anterior lobe is clearly marginate; the mesosternum is emarginate and the marginal stria sinuous and complete. The elytral subhumeral stria is complete.

Hab. Mexico (*Flohr*).

The late Mr. Julius Flohr, I believe, left his collections to the National Museum in Berlin, and therefore I presume there is an example of this species there. But on some occasions Mr. Flohr kindly gave me his unique specimens.

Hister rubricatus, sp. n.

Late ovalis, convexiusculus, nitidus, elytris apicalibus late rufis; fronte stria integra medio retro-acuminata; pronoto bifoveolato, stria laterali basi abbreviata; elytris striis 1–5 integris, suturali ante medium abbreviata.
L. $3\frac{1}{2}$ mill.

Oval, little convex, black, with the apical portion of the elytra broadly red; the head, frontal stria complete and in the middle drawn back to a sharp point; the thorax with a fovea and stria like those of *H. bimaculatus*, L., but the latter is more abbreviated; the elytra, striæ 1–5 complete, also internal subhumeral, sutural apical and occupying two thirds of the elytral length, the fifth stria at the base turns towards the scutellum much more conspicuously than the corresponding stria in *H. bimaculatus*; the propygidium and pygidium have a few scattered and fine punctures; the sternal plates are much wider than those of *H. bimaculatus*, otherwise they are similar. The anterior tibia has one large and wide apical tooth and four little ones behind it.

The great differences between this and the Linnean species *bimaculatus* lie in its short and broad-oval form, the form of the frontal stria, and the more markedly inturned fifth dorsal stria.

Hab. Cameroon.

Coproxenus, gen. nov.

Body rather convex, broadly or shortly oval; head small, retractile, forehead impressed, clypeus transverse, mandibles equal and dentate; antennæ, the club is oval and its fossa deep and in the anterior angle; the thorax is transverse, at the sides narrowing from the hind to the fore angle; the scutellum small and triangular; the elytra strongly carinate on the lateral edge (this carina takes the place of the usual external subhumeral stria), the internal subhumeral is also substituted by a carina less strong; the dorsal striæ are strong, and, in the two species known, complete, except the fifth; the pygidia are formed like those in *Pelorurus*; the prosternum is incised at the base, keel more or less wide, bistriate; the mesosternum anteriorly acuminate, with a strong marginal stria and a transverse crenulate one; the metasternum late-

rally bistriate; the tibiæ rather narrow, anterior thighs grooved for their whole length to receive the tibiæ *, tarsal groove open exteriorly, tarsi short and rather stout, with two claws.

Coproxenus Marshalli, sp. n.

Breviter ovatus, parum convexus, obscure rufo-brunneus, nitidus; capite punctulato, stria integra; elytris utrinque bicarinatis, striis 1–4 et suturali integris, 5 basi abbreviata; prosterno bistriato, interstitio parum lato.
L. 3 mill.

Shortly oval, little convex, obscure reddish brown, shining; the head, frontal stria complete, strong in the ocular region, feebler in front, not closely punctured, but the surface has a microscopic sculpture, slightly impressed anteriorly; the thorax sculptured like the head, stria complete and continuing in front, anterior angles a little prominent, obtuse, and a little raised within; the elytra, margin (equivalent of subhumeral external stria) carinate, carina not so robust as that of *C. opacipennis*, and within, the channel is smooth and even (without bosses); the next carina is complete, with a roughened edge; striæ formed as in *C. opacipennis*, but less distinct, owing to the interstices being convex and somewhat closely punctulate; the propygidium is clearly and not closely punctulate, the punctuation of the pygidium is less distinct; the prosternum with a microscopic surface strigosity and a few large punctures on the anterior lobe, keel rather wide, with 4 or 5 punctures set quite irregularly, bistriate, striæ straight, leaning to each other from the base and meeting anteriorly; the mesosternum, striæ complete, leaving a somewhat raised margin which has an ill-defined stria on either side; the transverse stria is roughly crenulate and bowed; the metasternum is strongly bistriate at the sides and the interstices are wide; the inner stria meets the mesosternal transverse stria, surface with large irregular punctures chiefly distributed in the middle of the plate on either side of a longitudinal median line; the first segment of the abdomen has a wide lateral stria and similar punctures to those on the metasternum, but on the anterior edge the points are regular and in a row.

I have much pleasure in naming this very curious species after Mr. Guy A. K. Marshall, who is the first entomologist who has sent home any considerable collection of Histeridæ from South Africa accompanied with notes on their habits.

Hab. Natal (no. 3598). "Taken in cow-dung" (*Marshall*).

* This character exists in *Pelorurus*, but is not noticed by Marseul.

Coproxenus opacipennis, sp. n.

Lato-ovatus, parum convexus, obscure rufo-brunneis; elytris opacis, utrinque bicarinatis, interstitiis planis, striis 1–4 et suturali integris, 5 basi abbreviata; prosterno angustato, bistriato.
L. 3 mill.

Broadly oval, pitchy brown or dark reddish brown, shining, elytra opaque; the head smooth and shining, frontal striæ complete, narrowly straight in front, with the space behind deeply impressed; the thorax clearly, not closely punctured, lateral stria continued behind the neck, anterior angle somewhat acute; the elytra are somewhat parallel between the shoulders until before the apex, the edge is a thick raised keel rounded off before and behind, within this keel there is a sulcus, and in the sulcus eight smooth little red bosses, within the bosses is a second carina (corresponding to a complete subhumeral internal stria) which is broken in four or five places, striæ 1–4 and sutural are complete, sutural and 4 joining at base, the striæ are rather wide, with minutely crenulate edges, 5 is shortened before the base, the interstices are flat and opaque; epipleuræ bistriate; the propygidium is clearly and not densely punctulate, the punctuation of the pygidium is less distinct; the prosternum, lobe with scattered and fine points, keel narrow, striæ meet in front and widen out slightly at the base, each stria has a regular row of about a dozen punctures along its course, interstice narrow; the mesosternum, stria strong and complete, but without the second stria on the margin, transverse stria as in the last species; the metasternal striæ are also similar to those of *C. Marshalli*, but they are regularly and conspicuously punctate, the surface is opaque, with a microscopic sculpture, and there is a series of irregular punctures on either side of the median line.

The remarkable row of little red bosses between the two lateral carinæ of the elytra is a character seen in no other known Histerid.

Hab. Cameroon.

Paratropus fungorum, sp. n.

Breviter ovalis, supra niger, nitidus, subtus obscure rufo-brunneus, pedibus rufis, antennis clava testacea: fronte, stria integra utrinque biangulata; pronoto parce et minutissime punctulato, punctis grossis intermixtis; elytris striis 1–4 suturalique integris, 5 basi abbreviata; prosterno striis posticis et anticis divergentibus.
L. $2\frac{1}{2}$–$2\frac{3}{4}$ mill.

Short-oval, black above, dark reddish brown beneath, legs red; the head rather feebly punctured with points of varying sizes, frontal stria complete, angulate on the anterior ocular edge and then passing obliquely to the front, it is short and straight behind the clypeus, within the anterior part of the stria there is a faint impression seen only in certain lights, the clypeus is transverse and convex on the anterior edge; the thorax narrowly carinate laterally, carina continued as a stria behind the head, surface irregularly punctured, points dispersed and of varying sizes, the largest are arranged chiefly along the base; the elytra—striæ, subhumeral external is represented by a well-marked complete marginal carina, internal absent, 1–4 and sutural complete and crenulate, fourth and sutural joined at the base, 5 shortened at the base to the width of an interstice; the propygidium, the punctuation is similar to the head, except that the larger punctures are close and more numerous; the pygidium, punctuation much less conspicuous; the prosternum bistriate, striæ diverging at both ends, more widely at the base, which they touch; the mesosternum acutely pointed, marginal stria strong and complete, with a second very fine stria between it and the anterior edge, the last scarcely meets in the middle, transverse stria is feebly bent and crenulate; the metasternum has a cluster of large punctures at either posterior angle, and the first abdominal segment has a row along its anterior edge.

This species is shorter (more approaching a circular form) than *P. meridianus*, Lew., and the fifth dorsal stria is longer and the colour different. *P. nigrella*, Sch., is also evidently similar, but Schmidt's species has a deep frontal impression.

Hab. Salisbury (alt. 5000 feet), Mashonaland. Taken in Fungi by Mr. Marshall.

Triballus agrestis, Marseul.

I have two specimens from Cameroon which I think are of this species, but they are not the species so named by Marseul and taken by Raffray at Zanzibar, and distributed many years ago by me as *T. agrestis*. In his description of *T. agrestis* Marseul says nothing about the mesosternal transverse stria. In the Cameroon species the mesosternal stria is bent and crenulate and consists of thirteen or fourteen crenulations; the Zanzibar species is similar, but has sixteen or seventeen crenulations. Marseul, in his description, not mentioning this stria, the question of specific identity can only be decided by a comparison with the type, which is in Paris. In *T. corpulentus*, Lew., the stria is straight, as

stated in the Ann. Soc. Ent. Belg. xxxviii. p. 216 (1894), and it has twenty-four very small crenulations.

Pygocœlis, gen. nov.

Type *P. africanus*, Lew.

This genus is established to receive certain African species allied to *Trypeticus*. The head is recumbent and the forehead declivous; the pygidium wholly concave; the prosternum twice as long as wide, widest anteriorly; the mesosternum, the anterior outline is feebly and rather widely arched and sinuous on either side. The prosternum in *Trypeticus* (type *T. gilolous*, Mars.) is "nearly square" and slightly widest at the base.

Pygocœlis africanus, Lewis.

The specimen from which the original description was drawn is somewhat immature; the examples before me now are dark, almost black; the prosternum is punctured and the surface rough; the punctures of the mesosternum are elongate and subaciculate. In six examples I fail to find any sexual characters such as those seen in *Tryponœus* and *Trypeticus*.

Hab. Togoland and Cameroon.

Pygocœlis duplicatus, sp. n.

Cylindricus, niger, nitidus; fronte minute strigosa, capite vertice punctato, punctis haud densis; pronoto punctato, stria laterali carinata, antice tenuiter impressa minute crenulata; prosterno antice striato, stria laterali antice abbreviata.

L. $3\frac{3}{4}$ mill.

Cylindrical, black, shining; the head, face minutely strigose, vertex punctured, punctures not close, evenly placed; the thorax rather longer than broad, depressed behind the eyes, anterior angles somewhat rounded off, surface punctured, punctures shallow, not very dense but evenly set, marginal stria carinate laterally, complete anteriorly and minutely crenulate; the elytra punctured like the thorax; the propygidium clearly and rather thickly punctured; the pygidium, punctures much larger and proportionally close; the prosternum as long again as wide, with a marginal (obsoletely crenulate) stria in front; laterally there is no stria anteriorly, but for about two thirds from the base there is a fine irregular stria, and in the lateral median region there is a longitudinal shallow furrow or impression, surface microscopically strigose,

with evenly scattered elongate or aciculate punctures; the mesosternum sculptured like the prosternum, but the punctures are all aciculate, arched anteriorly, very feebly sinuous on either side, sulcate on either side, but with no marginal stria anteriorly; the metasternum furrowed in the middle, punctures aciculate near the furrow, oval nearer the sides, margined along the base; the abdominal segments have round punctures somewhat closely set; the anterior tibiæ 5-dentate.

Hab. Cameroon.

Trypobius pinguis, sp. n.

Elongatus, cylindricus, niger, nitidus; capite convexo, clypeo bisinuato; pronoto pone oculos depresso, stria laterali valida; prosterno margine (basi excepta) subelevato; mesosterno utrinque sulcato.
L. $4\frac{1}{2}$ mill.

Elongate, cylindrical, robust, black, shining; the head, face convex, very polished, clypeus apically bisinuous, surface with small scattered punctures, and one large puncture on the vertex between the eyes; the thorax, lateral stria very strong and markedly sinuous, terminating at the anterior angle, behind the eye there is a distinct depression, surface distinctly punctured but not very densely, there is no median line; the elytra with a narrow smooth basal margin, punctured like the thorax, and so also are the propygidium and pygidium; the prosternum slightly incised at the base, parallel at the sides, lateral stria deep and straight and continued along the anterior margin, feebly punctulate, margin (except at the base) somewhat raised; the mesosternum obtusely acuminate in front, broadly sulcate on either side, the punctures and those of the metasternum are not so thickly set as the dorsal ones, the metasternum has a median channel; the anterior tibiæ are 5-dentate.

All the known species of this genus have a single notable puncture on the vertex of the head.

Hab. Cameroon.

Trypobius æthiops, sp. n.

Elongatus, cylindricus, niger, nitidus; capite convexo, pone oculos impresso; pronoto, stria laterali valida, profunde sinuato, lateralibus post medium prominulis; prosterno antice haud recto, basi tenuiter inciso; propygidio pygidioque vix dense punctatis.
L. $3\frac{1}{2}$ mill.

Elongate, cylindrical, black, shining; the head, face convex, sparingly punctured, with a strigose sculpture at the anterior edge of the eye, the vertical puncture is small; the thorax, lateral stria is wide, deep, and more deeply sinuous than that of *T. pinguis*, and the edge of the thorax is also deeply sinuous, the sinuosity ending abruptly behind the middle forms an obtusely dentate projection behind it; before the scutellum the punctures leave a narrow irregular smooth space not well defined, behind the eye is a distinct impression; the elytra very narrowly smooth at the base, and the pygidia are more clearly punctured than those of the last species, especially the pygidium; the prosternum is not straight in front, but feebly cut out in a bow-shaped outline from angle to angle, feebly incised at the base, stria complete at the sides and front, margin slightly raised; the mesosternum is sulcate at the sides, obtusely pointed anteriorly; all the sternal plates are evenly punctured, the punctures well separated from each other; the anterior tibiæ 5-dentate, teeth not prominent.

Hab. Cameroon.

Trypobius cylindraceus, sp. n.

Elongatus, cylindricus, niger, nitidus: capite convexo; thorace antice haud foveolato: prosterno antice late emarginato; mesosterno utrinque sulcato; tibiis anticis 5-dentatis.

L. 3 mill.

Elongate, cylindrical, black, shining; the head, face convex, very polished, minutely strigose at the eyes, rather sparsely punctured, vertical puncture very small; clypeus bisinuous; the thorax much more densely punctured than the last species, with a narrow sinuous impression behind the eye, lateral stria deep, sinuous, but the prominent angle is not conspicuous like that of *T. æthiops*; the elytra not quite so densely punctured as the thorax; the propygidium and pygidium are densely punctured; the prosternum is entirely emarginate in front, feebly incised at the base, widest in front, narrowed behind, lateral stria straight and transversely joining in front; the mesosternum is obtuse anteriorly, the metasternum canaliculate in the middle, all the sternal plates similarly punctured; the anterior tibiæ 5-dentate.

This is the smallest and narrowest species of this series.

Hab. Cameroon.

XVI.—*On a Collection of Heterocera made in the Transvaal.*

By W. L. Distant.

This paper concludes the enumeration of my Transvaal Heterocera — Sphinges and Bombyces — as included in Mr. Kirby's first volume of his 'Synonymic Catalogue of Lepidoptera Heterocera.' A few Sesiidæ have still to be recorded, and then the Noctuidæ and Geometridæ will be worked out. Sir G. F. Hampson has kindly promised to undertake the description of the Pyralidæ, and my Tineidæ, by the favour of Lord Walsingham, will receive the efficient treatment afforded these moths at his Merton Museum.

In the constitution of the families I have followed the excellent "keys" afforded by Hampson in his standard and almost generally followed work on Heterocera in the 'Fauna of British India,' and have sought to locate the African genera in the same system of family arrangement as he has laid down for the Oriental moths. The grouping of these families has, for the sake of general convenience, more or less followed the arrangement in Mr. Kirby's Catalogue. The last matter is still a somewhat open question, and will probably see much fluctuation before finality is obtained.

I hope eventually to figure all the new species described, both in this and other orders, in a future work.

Where not otherwise specified the captures were my own.

Fam. Agaristidæ.

Species obtained in the Transvaal.

Xanthospilopteryx superba, Butl. Barberton (*Dr. P. Rendall*), Pretoria.
Ægocera fervida, Walk. Barberton (*Dr. P. Rendall*), Pretoria.
Ovios capensis, Herr.-Schäff. Barberton (*Dr. P. Rendall*).
Pais decora, Linn. Pretoria.

Fam. Arctiidæ.

Species obtained in the Transvaal.

Pelochyta madagascariensis, Boisd. Lydenburg District (*Zutrzenka*).
Apisa canescens, Walk. Barberton (*Dr. P. Rendall*), Pretoria.
Decimia bicolora, Walk. Volksrust.
Anace lateritia, Herr.-Schäff. Heidelberg, Pretoria.
Metarctia rufescens, Walk. Barberton (*Dr. P. Rendall*), Pretoria.
Rhodogastria amasis, Cram. Pretoria.
Spilosoma dissimilis, sp. n. Pretoria.
Sœnura flava, Wallengr. Barberton (*Dr. P. Rendall*), Pretoria.
Leucaloa eugraphica, Walk. Pretoria.

Eyralpenus testaceus, Walk. Barberton (*Dr. P. Rendall*).
Seirarctia trivitta, Walk. Pretoria.
Phissama lutescens, Walk. Pretoria.
—— *scortillum*, Wallengr. Pretoria.
Teracotona submacula, Walk. Pretoria.
Diaphone sylviana, Stoll. Pretoria.
Lacydes linea, Walk. Barberton (*Dr. P. Rendall*), Lydenburg District (*Zutrzenka*), Pretoria.
Eutænia scapulosa, Wallengr. Zoutpansberg (*Kæssner*).
Callimorpha bellatrix, Dalm. Barberton (*J. R. Harrison*).

Sænura flava, Wallengr. Wien. ent. Mon. iv. p. 162. n. 9 (1860), = *Euchætes madagascariensis*, Butl. Cist. Ent. iii. p. 3 (1882).

Spilosoma dissimilis, sp. n.

Head and pronotum golden yellow; antennæ fuscous; abdomen above ochraceous, with three longitudinal series of black spots (one central and one on each lateral margin); body beneath with legs fuscous.

Anterior wings golden yellow, with a small obscure brownish spot at end of cell; posterior wings dark purplish brown, with the inner and outer margins golden yellow, and with a small discal spot of the same colour. Anterior wings beneath as above; posterior wings beneath with the whole basal area yellowish.

Exp. wings 33 millim.

Hab. Transvaal, Pretoria (*Distant*).

Fam. **Lithosiidæ**.

Species obtained in the Transvaal.

Bizone pretoriæ, sp. n. Pretoria.
Gnophria (?) *argentata*, sp. n. Pretoria.
Manulea fumeola, Walk. Pretoria.
Utetheisa pulchella, Linn. Pretoria.
Siccia caffra, Walk. Pretoria.
Petovia marginata, Walk. Pretoria.
—— *dichroaria*, Herr.-Schäff. Pretoria.
Secusio strigata, Walk. Zoutpansberg (*Kæssner*).
Nyctemera apicalis, Walk. Barberton.

Species obtained in Natal.

Aletis libyssa, Hopff. Durban.
Nyctemera apicalis, Walk. Durban.

Bizone pretoriæ, sp. n.

Body above creamy white; pronotum with four sanguineous spots; antennæ and legs dull ochraceous; apices of the tarsi black.

Wings pale creamy white; anterior wings with four transverse sanguineous fasciæ—one near base not reaching inner margin, second and third completely crossing wing, fourth short and not reaching costal margin, near apex; between the second and third fasciæ are two black spots situate in and at end of cell.

Exp. wings 32–33 millim.

Hab. Transvaal, Pretoria (*Distant*).

Allied to *B. delicata*, Walk., from Sierra Leone, but can be separated alone by the position of the two black spots on the anterior wing, which are placed horizontally, and not vertically as in Walker's species.

Gnophria (?) *argentata*, sp. n.

Head golden yellow; antennæ brownish ochraceous; pronotum silvery white, with a submarginal anterior fascia and the apices of the lateral plumes yellow; abdomen golden yellow, with transverse brownish segmental fasciæ; legs yellow, tibiæ and tarsi with brown annulations.

Anterior wings silvery white; costal margin and two waved transverse fasciæ on apical half, the outermost of which is looped near apex, black, inner margin and fringe of outer margin yellow: posterior wings golden yellow, the costal area (broadest at apex) fuscous. Anterior wings beneath dark fuscous, the margins yellow; posterior wings beneath golden yellow, with a cellular streak and an outer submarginal fascia fuscous.

Exp. wings 37 millim.

Hab. Transvaal, Pretoria (*Distant*).

Allied to *G.* (?) *furcifasciata*, Butl., from British Central Africa.

Fam. **Hypsidæ.**

Pseudhypsa subretracta, Walk. Barberton (*Dr. P. Rendall*), Pretoria.

Egybolis Vaillantina, Stoll. Natal, Durban; Delagoa Bay.

Fam. **Lymantriidæ.**

Species obtained in the Transvaal.

Lælia municipalis, sp. n. Pretoria.
Creagra adspersa, Herr.-Schäff. Barberton (*Dr. P. Rendall*), Pretoria.
Lacipa gemmata, sp. n. Pretoria.
—— *diffusa*, sp. n. Pienaars River.
—— *sexpunctata*, sp. n. Pretoria.

Euproctis torrida, sp. n. Barberton (*Dr. P. Renaall*), Zoutpansberg (*Kæssner*), Pretoria.
—— *stellata*, sp. n. Pretoria.
Aroa perculta, sp. n. Pretoria.
Lymantria tessellata, sp. n. Lydenburg District (*Zutrzenka*).
Polymona rufifemur, Walk. Pretoria.
Dasychira extatura, sp. n. Pretoria.
—— *extorta*, sp. n. Pretoria.
—— *Rendalli*, sp n. Barberton (*Dr. P. Rendall*).
Psalis securis, Hübn. Pretoria.
Notolophus quadripunctatus, Wallengr. Pretoria.

Cimola opalina, Walk. Natal, Durban.

Lælia municipalis, sp. n.

Head, antennæ, and pronotum pale tawny; abdomen pale shining ochraceous.

Anterior wings very pale tawny, minutely and irregularly speckled with fuscous, rather darker at base and at end of cell, with an outer submarginal series of small black spots and a very obscure discal series of yellow spots beneath and at end of cell; posterior wings still paler tawny, slightly darker at apical area. Wings beneath much as above, but anterior wings lacking the black and yellow spots.

Exp. wings 35 millim.

Hab. Transvaal, Pretoria (*Distant*).

Lacipa gemmata, sp. n.

Head, pronotum, and base of abdomen silvery white; abdomen (excluding base) more or less ochraceous, with its extreme apex black; antennæ, body beneath, and legs more or less ochraceous. Wings silvery white: anterior wings with the costal margin (excluding base) golden yellow, four transverse series of similarly coloured spots, one at base slightly curved outwardly, the others directed obliquely inwardly from costa, second crossing cell, third beyond cell, and fourth submarginal; in the third series, and just beyond cell, two of the spots are almost entirely black. Anterior wings beneath with the markings paler; posterior wings beneath with the costal (broadly) and the outer margin (narrowly) ochraceous.

Exp. wings 31–33 millim.

Hab. Transvaal, Pretoria (*Distant*).

Lacipa diffusa, sp. n.

Body, legs, and antennæ very pale ochraceous.

Wings creamy white, with the costal margin narrowly pale

ochraceous, its whole area sparingly, irregularly, and minutely flecked with black; the speckles form a cluster in and near end of cell, and are arranged somewhat in three series beyond it; an outer marginal series of small black spots. Anterior wings beneath with the black markings very indistinct; posterior wings beneath with the costal (broadly) and the outer margin (narrowly) ochraceous.

Exp. wings 35 millim.

Hab. Transvaal, Pienaars River (*Distant*).

Lacipa sexpunctata, sp. n.

Head and pronotum silvery white; antennæ and humeral angles of pronotum ochraceous; abdomen and legs more or less very pale ochraceous.

Wings above silvery white; anterior wings with a small black spot beneath base of cell, six similar spots at end of cell (four in and above and two beneath), and an outer submarginal series of black spots; three slightly waved and disconnected yellow fasciæ, one close to base, the second crossing cell, and the third placed beyond it, the third oblique, the second somewhat curved. Wings beneath with the markings paler than above.

Exp. wings 26 millim.

Hab. Transvaal, Pretoria (*Distant*).

Allied to *L. quadripunctata*, Dewitz.

Aroa perculta, sp. n.

Body and legs ochraceous; tibiæ and tarsi streaked with fuscous; antennal branches fuscous.

Wings ochraceous; anterior wings with the apical portion of costal margin and the whole of outer margin blackish, most of the veins on the apical third also distinctly blackish; posterior wings with the outer margin blackish, close to which the veins are also infuscated. Wings beneath with the black markings less pronounced than above.

Exp. wings 26–30 millim.

Hab. Transvaal, Pretoria (*Distant*).

Lymantria tessellata, sp. n.

Body and legs ochraceous, tinged with black; antennæ black, with the branches brown.

Anterior wings creamy white, much mottled with black, the vein closing cell reddish ochraceous; the black markings are largest and most suffused on cellular and apical areas,

beyond cell they form a narrow waved transverse fascia and along inner margin a double series of spots; posterior wings creamy white, marked with black at abdominal and apical angles. Wings beneath as above, but posterior wings with black costal markings.

Exp. wings 35 millim.

Hab. Transvaal, Lydenburg District (*Zutrzenka*).

Euproctis torrida, sp. n.

Body, legs, and antennæ pale ochraceous, the abdomen somewhat darker in hue and with the apex sometimes blackish.

Anterior wings very pale ochraceous, ornamented with a number of black speckles, which form a broad oblique fascia from end of cell to about middle of inner margin, two small and irregular clusters in and near end of cell, and some still smaller submarginal clusters near apex and inner angle; the oblique fascia is margined with golden yellow, which colour is continued in another direction to costa: posterior wings pale golden yellow. Wings beneath uniform golden yellow, with scarcely a trace of the black markings on the upperside.

Exp. wings 34–42 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*); Zoutpansberg (*Kæssner*); Pretoria (*Distant*).

Euproctis stellata, sp. n.

Body and legs pale ochraceous, the abdomen somewhat darker in hue and with the apex dark fuscous.

Anterior wings very pale ochraceous, with a small reddish spot near end of cell and with some black speckles forming a short obscure fascia from a little beneath cell to about middle of inner margin; posterior wings pale golden yellow, with the fringe stramineous. Wings beneath golden yellow, the anterior wings exhibiting the reddish spot, but not the black markings.

Exp. wings 35–38 millim.

Hab. Transvaal, Pretoria (*Distant*).

Dasychira extatura, sp. n.

Body dark greyish, mottled with black; pronotum with the anterior margin, the lateral plumes, and the base pale brownish, the last two speckled with black, sometimes bluish metallic; abdominal anal tuft pale greyish brown; tibiæ and tarsi ochraceous, the last annulated with castaneous.

♂. Anterior wings greyish brown, very thickly speckled, and crossed by four linear dark fasciæ, the first much angulated at base, the second straightest at one third from base, the third very much waved and angulated beyond cell, the fourth undulating and submarginal; between the first and second are some groups of black speckles, between the second and third a looped lineate fascia across cell, and between third and fourth a dark lineate costal spot: posterior wings pale creamy white, with a small fuscous marginal spot at apical angle. Wings beneath creamy white; anterior wings with the costal, cellular, and apical areas infuscated; posterior wings besides the apical marginal spot also possessing a spot at extremity of cell and another near outer margin.

♀. The anterior wings clouded with black, especially at base and at the area of the third transverse fascia; posterior wings with faint indications of a dark submarginal fascia and beneath with a more strongly indicated transverse discal fascia.

Exp. wings, ♂ 35, ♀ 43 millim.

Hab. Transvaal, Pretoria (*Distant*).

Dasychira extorta, sp. n.

♂. Body above brownish ochraceous, beneath with legs and antennæ pale ochraceous.

Anterior wings brownish ochraceous, mottled and shaded with blackish brown; these dark markings are more prominent and continuous at base and apex, where they occupy the basal and apical thirds of wing; in the intervening space is a costal spot extending about one third across wing: posterior wings pale ochraceous. Wings beneath pale ochraceous: anterior wings exhibiting a spot at end of cell, a submarginal fascia and costal infuscation; posterior wings similarly marked.

Exp. wings 35 millim.

Hab. Transvaal, Pretoria (*Distant*).

Dasychira Rendalli, sp. n.

♂. Head and pronotum dark brownish; abdomen, body beneath, legs, and antennæ paler in hue.

Anterior wings dark brownish, crossed by five waved dark fasciæ—first near base, second crossing cell, third beyond cell and very much contorted, fourth a little beyond third, and fifth submarginal; between the first and second there is an irregular discal spot: posterior wings pale ochraceous. Wings beneath paler than above and dusky; anterior wings

exhibiting a transverse oblique fascia a little beyond cell, and posterior wings with a similar but transverse fascia; both wings somewhat thickly speckled with brownish.

Exp. wings 32 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

Fam. **Limacodidæ**.

Species obtained in the Transvaal.

Crothæma decorata, Dist. Barberton (*Dr. P. Rendall*), Pretoria.
Cœnobasis amœna, Feld. Lydenburg District (*Zutrzenka*).
Parasa ætitis, Wallengr. Pretoria, Pienaars River.
—— *latistriga*, Walk. Pretoria.
Apluda invitabilis, Wallengr. Pretoria.
—— *similis*, sp. n. Waterberg (*Wilde*).

Apluda similis, sp. n.

Head above, pronotum, and base of abdomen silvery white; anterior margin and under surface of head, antennæ, abdomen (excluding base), and legs dark ochraceous; legs annulated with dark castaneous.

Wings silvery white: anterior wings with the costal margin and two thirds of inner margin, attached by two transverse and oblique fasciæ twice connected (thus enclosing four white spots), pale castaneous; outer margins of both wings narrowly of the same colour. Wings beneath as above, but anterior wings with the oblique fasciæ imperfectly seen, but the costal area and apical veins dark castaneous.

Exp. wings 25 millim.

Hab. Transvaal, Waterberg (*Wilde*).

Fam. **Notodontidæ**.

Species obtained in the Transvaal.

Desmeocræra hierax, sp. n. Lydenburg District (*Zutrzenka*), Pretoria.
—— *vernalis*, sp. n. Barberton (*Dr. P. Rendall*).
Anaphe reticulata, Walk. Pretoria.
Rigema Woerdeni, Snell. Pretoria.
—— *ornata*, Walk. Waterberg (*Wilde*), Pretoria.
Antheua simplex, Walk. Pretoria.

Desmeocræra hierax, sp. n.

Body and legs griseous.

♂. Anterior wings hoary, minutely speckled with fuscous, basal third distinctly darker; a dark oblique spot from near apex to a little beyond end of cell; a spot at inner angle;

outer marginal area obscurely infuscated: posterior wings dull white, outer margin narrowly and a spot at anal angle fuscous. Anterior wings beneath fuscous, unicolorous; posterior wings beneath as above, but with the costal area speckled and containing two obscure fuscous spots.

♀. Anterior wings with the basal third, a small spot at end of cell, and a broad irregular submarginal fascia pale fuscous; posterior wings thickly and finely speckled with brown and containing an obscure transverse discal fascia.

Exp. wings, ♂ 35, ♀ 40 millim.

Hab. Transvaal, Pretoria (*Distant*); Lydenburg District (*Zutrzenka*).

Desmeocræra vernalis, sp. n.

Head and pronotum pale greenish; abdomen and body beneath greenish ochraceous.

♂. Anterior wings pale greenish, obscurely speckled with brownish; indications of an oblique brownish fascia near base and a more regular linear waved outer submarginal fascia of the same colour: posterior wings very pale ochraceous. Wings beneath paler than above.

Exp. wings, ♂, 37 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

Fam. **Eupterotidæ.**

Species obtained in the Transvaal.

Jana edulis, Boisd. Barberton (*J. R. Harrison*).
—— *eurymas*, Herr.-Schäff. Pretoria.
—— *rhodoptera*, Gerst. Barberton (*Dr. P. Rendall*).
—— (?) *subrosea*, Auriv. Pretoria.
Phyllalia concolor, Walk. Barberton (*J. R. Harrison*).
Phiala costipunctata, Herr.-Schäff. Barberton (*Dr. P. Rendall*), Pretoria, Pienaars River.
—— *incana*, sp. n. Pretoria.
—— *polita*, sp. n. Barberton (*Dr. P. Rendall*).
Sangatissa pretoriæ, Dist. Pretoria.
Stenoglene obtusa, Walk. Pretoria.
—— *isabellina*, Auriv. Pretoria.
—— *bicolor*, sp. n. Pienaars River, Pretoria.
Rhabdosia paragarda, Wallengr. (?). Pretoria.

Phiala incana, sp. n.

Head, antennæ, abdomen, body beneath, and legs ochraceous; pronotum milky white; tarsi annulated with blackish.

Wings milky white; anterior wings obscurely, sparingly, and irregularly speckled with dark fuscous; posterior wings

with a few scattered discal speckles of dark fuscous. Wings beneath unicolorous.

Exp. wings, ♂, 44 millim.

Hab. Transvaal, Pretoria (*Distant*).

Apparently allied to *P. dasypoda*, Wallengr., but separated at once by the yellow abdomen.

Phiala polita, sp. n.

Body, legs, and wings pale bright ochraceous.

Anterior wings speckled with black obliquely beneath cell, near centre of inner margin, and near posterior half of outer margin; posterior wings with two or three speckles near outer margin. Both wings beneath somewhat thickly speckled with pale brownish.

Exp. wings, ♂, 40 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

Allied to *P. flavipennis*, Wallengr.

Stenoglene (*Chrysopoloma*) *isabellina*, Auriv. Ent. Tidskr. xvi. p. 119 (1895), ♂, = *S.* (*C.*) *similis*, Auriv. ib., ♀.

Stenoglene bicolor, sp. n.

Head, abdomen, body beneath, and legs ochraceous; pronotum fawn-colour, with its anterior margin moderately ochraceous; legs and antennæ black.

Anterior wings pale fawn-colour, posterior wings ochraceous. Wings beneath pale fawn-colour, with a yellowish tinge, the anterior wings ochraceous at base and costal area.

Exp. wings 47 millim.

Hab. Transvaal, Pretoria, and Pienaars River (*Distant*).

Apparently allied to *S. bithynia*, Druce.

Fam. **Lasiocampidæ.**

Species obtained in the Transvaal.

Sarothropyga rhodopepla, Feld. Lydenburg District (*Zutrzenka*).
Dendrolimus cuneata, sp. n. Lydenburg District (*Zutrzenka*), Pretoria.
—— *gemmata*, sp. n. Lydenburg District (*Zutrzenka*).
Lenodora (?) *nigrolineata*, Auriv. Barberton (*Dr. P. Rendall*).
Bombycomorpha pallida, sp. n. Pretoria.
Beralade perobliqua, Walk. Pretoria.
—— *fumosa*, sp. n. Barberton (*Dr. P. Rendall*), Waterberg (*Wilde*).
Concædes carinata, Wallengr. Pretoria.
Nadiasa levenna, Wallengr. Heidelberg.
Chilena prompta, Walk. Pienaars River.
Odontocheilopteryx myxa, Wallengr. Lydenburg District (*Zutrzenka*), Pretoria.

Taragama mirabilis, sp. n. Lydenburg District (*Zutrzenka*).
Caphara fulvida, sp. n. Pretoria.
Gonometa postica, Walk. Pretoria.
—— *cuprea*, sp. n. Lydenburg District (*Zutrzenka*).
Braura lignicolor, Walk. Barberton (*J. R. Harrison*), Lydenburg District (*Zutrzenka*).

Dendrolimus cuneata, sp. n.

Head and pronotum griseous brown, the last with two large castaneous lateral spots; abdomen, body beneath, and legs pale castaneous, apex of abdomen paler in hue; antennæ castaneous, with the branches ochraceous.

Anterior wings greyish brown, castaneous at base, black at base of costal margin, with a large wedge-shaped greyish patch on inner margin, and crossed by two linear fuscous and grey fasciæ directed inwardly from costa; an obscure waved submarginal castaneous line, the fringe, and outer two thirds of costa greyish ochraceous: posterior wings very pale castaneous, darker on basal area. Wings beneath pale castaneous, the anterior wings just exhibiting the outer dark linear fascia.

Exp. wings, ♂, 38–50 millim.

Hab. Transvaal, Lydenburg District (*Zutrzenka*), Pretoria (*Distant*).

This species is allied to *D. aculeata*, Walk., from which it may be separated at once by the different direction of the postmedial linear fascia of the anterior wings.

Dendrolimus gemmata, sp. n.

Body and legs pale ochraceous; abdomen above somewhat darker, with the segmental margins black.

Wings pale greenish ochraceous: anterior wings with a small black spot at end of cell, beyond which they are crossed by three narrow greyish fasciæ—the first and second oblique, the third near margin very much bent inwardly; extreme outer margin with greyish spots: posterior wings with a small black spot at end of cell, and the outer margin broadly greyish, with some green shadings. Wings beneath as above, but paler, and with the greyish fasciæ less distinct.

Exp. wings, ♂, 43 millim.

Hab. Transvaal, Lydenburg District (*Zutrzenka*).

Most nearly allied to *D. protracta*, Herr.-Schäff.

Bombycomorpha pallida, sp. n.

Body milky white, legs and antennæ ochraceous.

Wings milky white; anterior wings with a reddish-brown

spot at end of cell. Wings beneath as above, but anterior wings with the costal area brownish ochraceous.

Exp. wings, ♂, 35–38 millim.

Hab. Transvaal, Pretoria (*Distant*).

Allied to *B. bifascia*, Walk.

Beralade fumosa, sp. n.

♂ ♀. Body mouse-colour, antennæ and legs ochraceous, tarsi annulated with black.

Wings mouse-colour; anterior wings with the costal margin ochraceous and with two oblique narrow macular fuscous fasciæ extending from near apex to inner margin—in the male the outermost of these fasciæ is extremely indistinct. Wings beneath darker than above and without fasciæ.

Exp. wings 45 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*), Waterberg (*Wilde*).

Much larger and of a different hue to *B. perobliqua*, Walk., the only other described species of the genus.

Taragama mirabilis, sp. n.

♂. Head and pronotum fawn-colour; abdomen above ochraceous, fawn-colour towards apex, which is castaneous; body beneath and legs pale castaneous, centre of abdomen fawn-colour, tarsi annulated with ochraceous; antennæ brownish ochraceous.

Anterior wings pale brownish, crossed about middle by two slightly waved narrow fuscous fasciæ, between which and the base the colour is more reddish ochraceous; posterior wings bright ochraceous, paler towards apex. Wings beneath paler than above: anterior wings shaded with ochraceous and without fasciæ; posterior wings with the costal area brownish.

♀. Body and legs bright reddish brown; abdomen above somewhat paler; antennæ black, with the branches ochraceous.

Wings above uniform bright reddish brown, the transverse fasciæ to the anterior wings (as in the male) very indistinct. Wings beneath rather paler than above and unicolorous.

Exp. wings, ♂ 56, ♀ 60 millim.

Hab. Transvaal, Lydenburg District (*Zutrzenka*).

I have little doubt of these two differently coloured moths being the sexes of one species. They were caught by the same collector and on the same excursion.

Caphara fulvida, sp. n.

Head and pronotum dark mouse-colour; abdomen, antennæ, body beneath, and legs more or less ochraceous, tarsi speckled with greyish.

Anterior wings dark mouse-colour, thickly speckled with grey, the venation ochraceous, and with two dark waved linear outer submarginal fasciæ; inner basal angles dull ochraceous: posterior wings dull ochraceous, semihyaline, the outer area infuscated. Both wings beneath dull obscure ochraceous, with their outer areas infuscated.

Exp. wings 60 millim.

Hab. Transvaal, Pretoria.

Allied to *C. marginata*, Walk., differing by the different colour of the posterior wings, absence of "black discal mark" to the anterior wings, &c.

Gonometa cuprea, sp. n.

♀. Body and legs more or less castaneous; abdomen above pale brownish; antennæ black, with the branches ochraceous.

Anterior wings above greyish brown, with reddish and fuscous suffusions; a bent, narrow, elongate reddish spot at end of cell, and a broken waved reddish submarginal fascia; the basal inner margin is blackish: posterior wings pale reddish brown. Wings beneath paler than above, almost uniform reddish ochraceous.

Exp. wings, ♀, 85 millim.

Hab. Transvaal, Lydenburg District (*Zutrzenka*).

Fam. Arbelidæ.

Species obtained in the Transvaal.

Arbela tegula, sp. n. Pretoria.
Salagena tessellata, sp. n. Pretoria.

Arbela tegula, sp. n.

Body greyish white, slightly tinged with pale ochraceous; pronotum and antennæ ochraceous.

Anterior wings shining greyish white, somewhat closely crossed by transverse ochraceous fasciæ, which are much darker on the inner area; a reddish ochraceous spot at end of cell: posterior wings shining greyish white, suffused with pale ochraceous. Wings beneath very pale ochraceous, unicolorous.

Exp. wings 36 millim.

Hab. Transvaal, Pretoria (*Distant*).

Salagena tessellata, sp. n.

Body very pale ochraceous, with silvery suffusions; eyes black; antennæ ochraceous.

Anterior wings milky white, somewhat thickly sprinkled with short black and ochraceous strigæ, of which the black are much more numerous; posterior wings pale shining ochraceous. Anterior wings beneath much paler than above; posterior wings beneath as above.

Exp. wings 26 millim.

Hab. Transvaal, Pretoria (*Distant*).

Fam. **Cossidæ.**

Species obtained in the Transvaal.

Zeuzera asylas, Cram. Pretoria (*T. Donovan*).
Xyleutes capensis, Walk. Barberton (*Dr. P. Rendall*).
Chrysotypus Dawsoni, sp. n. Barberton District (*Dawson*).

Chrysotypus Dawsoni, sp. n.

Body and legs pale ochraceous; head, antennæ, and anterior margin of pronotum darker in hue.

Anterior wings brownish ochraceous, crossed by six dark linear fasciæ—the first three near base and more or less distinctly forked near costa; fourth a little beyond cell, forked above, but not reaching beyond the altitude of the subcostal nervure; fifth forked beneath at outer angle; sixth at apex and forked beneath: between these linear fasciæ are numerous strigæ of the same colour. Posterior wings crossed by corresponding linear fasciæ and strigæ. Wings beneath as above.

Exp. wings 40 millim.

Hab. Transvaal, Barberton District (*W. E. Dawson*).

Somewhat closely allied to the type and hitherto sole representative of the genus, *C. dives*, Butl., from Madagascar.

Fam. **Hepialidæ.**

Species obtained in the Transvaal.

Dalaca ibex, Wallengr. Pretoria.
—— *nomaqua*, Walk. Pretoria.
—— *cretata*, sp. n. Pretoria.
Gorgopis libania, Stoll. Pretoria.
—— *caffra*, Walk. (?). Zoutpansberg (*Kæssner*), Pretoria.

Dalaca cretata, sp. n.

Body and legs brown; antennæ brownish ochraceous.

Wings pale brown; anterior wings with a large milky-white curved fascia, commencing at base, extending longitudinally about two thirds across wing, and then abruptly curved upwardly, and terminating before apex at the altitude of the cell. Wings beneath brown, with scarcely a trace of the white fascia above.

Exp. wings 22 millim.

Hab. Transvaal, Pretoria.

XVII.—*Descriptions of Two new Species of* Amphidromus.

By Hugh Fulton.

[Plate VI.]

Amphidromus floresianus, sp. n. (Pl. VI. fig. 2.)

Shell sinistral, solid, imperforate, oblong-conic; whorls 7, moderately convex, apex dark brown, second and third whorls flesh-coloured, remainder whitish above to yellow below, ornamented on middle whorls by two spiral rows of irregular squarish brown spots, lower whorls either plain yellow or with from one to ten brown spiral lines, which are sometimes continuous, sometimes interrupted; lip and lower part of columella almost black, polished, and connected by a rather thick, reddish, transparent callus; lip moderately expanded and reflected, columella almost straight, having rather an angular appearance at lower part, where it joins the lip.

Long. 44 millim., maj. diam. 20.

Type in British Museum.

Loc. South Flores (*Everett*).

Like nearly all other species of *Amphidromus* this varies somewhat in form and much in coloration; some specimens are broader and shorter than the type and others more elongated. In one or two specimens collected by Mr. Everett the last whorl is almost covered by oblique stripes of a reddish-brown colour. The most prominent distinguishing feature of this species is its black lip, which appears to be constant.

Amphidromus consobrinus, sp. n. (Pl. VI. fig. 3.)

Shell sinistral, oblong-conic, slightly perforate; whorls 6, convex, yellow below fading to dirty white above, first three

whorls of a semitransparent flesh-colour, tipped at the apex with dark brown, last whorl obsoletely keeled at the periphery; there is a narrow greyish-blue band just above the umbilical area, which is continued spirally upon the parietal wall; lip and columella pale purple, connected by a thin reddish-brown callus; lip slightly expanded and reflected; interior of aperture white.

Long. 32 millim., maj. diam. 15 millim.

Type in British Museum.

Loc. South Flores Island (*Everett*); Sumba Island.

Some specimens have an additional narrow spiral band just below the periphery. This species is very closely allied to my *A. sumbaensis*, but can easily be distinguished by its different coloration.

XVIII.—*On supposed new Species of* Oleacina, Trochomorpha, *and* Bulimulus. By Hugh Fulton.

[Plate VI.]

Oleacina Underwoodi, sp. n. (Pl. VI. fig. 9.)

Shell ovate-conic, moderately thin, dark reddish brown, polished, almost smooth, growth-lines showing more distinctly at and below the suture, which is very narrowly but distinctly filleted; whorls 5½, slightly convex; apex obtuse; aperture ovate, a little less than half the length of the shell; lip simple, scarcely thickened; columella incurved, truncate.

Long. 21 millim., maj. diam. 11 millim.

Type in British Museum.

Loc. Asaha Centago, Costa Rica (*C. F. Underwood*).

The nearest species to this is *aurantiaca*, Angas, but that species is of a much more elongate form and lighter colour.

Trochomorpha (*Videna*) *andamanica*, sp. n. (Nevill, MS.). (Pl. VI. figs. 4, 4 *a*, 4 *b*.)

Shell subcircular, light yellowish brown; umbilicus wide, funnel-shaped and sharply angled; whorls 6½, slowly increasing, suture bordered with a depressed and well-defined narrow margin, obliquely striated by growth-lines above and below, last whorl compressed at the margin and acutely keeled; aperture very oblique, lip slightly thickened.

Maj. diam. 14 millim., height 4½ millim., width of umbilicus 5 millim.

Type specimen in British Museum.

Loc. Port Blair, Andaman Islands.

Distinguished from *sanis*, Bens., by its less rapidly increasing whorls and its angular funnel-shaped umbilicus; *pseudosanis* is not quite so flat, generally smaller, and has not so wide an umbilicus.

Trochomorpha (*Videna*) *pseudosanis*, sp. n. (Nevill, MS.).
(Pl. VI. figs. 5, 5 *a*, 5 *b*.)

Shell openly umbilicate, dark brown, obliquely striated above and below; whorls $5\frac{1}{2}$, slowly increasing, suture with a narrow well-defined margin, last whorl sharply keeled; aperture oblique; peristome scarcely thickened.

Maj. diam. 13 millim., height 5 millim., width of umbilicus 4 millim.

Type in British Museum.

Loc. Port Blair, Andaman Islands.

This species is allied to *andamanica*, but is generally smaller, has a slightly more conical spire, a whorl less, and the umbilicus is narrower and not so sharply angled at the margin.

Bulimulus (*Drymœus*) *Baroni*, sp. n.
(Pl. VI. figs. 8, 8 *a*, 8 *b*.)

Shell slightly umbilicate and broadly rimate, solid, either light brown with a narrow whitish spiral band at the suture or dirty white with spiral bands of a light brown colour; the fine longitudinal striæ or lines of growth are irregularly microscopically wrinkled; apex blunt, apical whorls whitish, with close-set minute thimble-like punctures; whorls $6\frac{1}{4}$–$6\frac{3}{4}$, convex, the last rather suddenly deflected, giving the umbilical area a rimose character; aperture ovate, dark brown within, one half to three fifths the length of shell; lip broadly expanded, outer margins white; parietal callus very thin.

Long. 34 millim., maj. diam. 22 millim.
„ 36 „ „ 21 „
„ 31 „ „ 19 „

Type specimens (three) in British Museum.

Loc. Rio Yonan, Peru, 4000 feet (*C. T. Baron*).

Resembles *D. proteus*, Brod., in its variableness of form and coloration, but has not the characteristic granular sculpture of that species. It is closely allied to *cora*, d'Orb., but is smaller, with more conical spire, and of a more solid growth.

EXPLANATION OF PLATE VI.*

Fig. 1. *Amphidromus sumbaensis* *.
Fig. 2. —— *floresianus.*
Fig. 3. —— *consobrinus.*
Figs. 4, 4 *a*, 4 *b*. *Trochomorpha andamanica.*
Figs. 5, 5 *a*, 5 *b*. —— *pseudosanis.*
Fig. 6. *Porphyrobaphe approximata* *.
Figs. 7, 7 *a*. *Helix* (*Xenothauma*) *Baroni* †.
Fig. 7 *b*. Ditto *. Nucleus.
Figs. 8, 8 *a*, 8 *b*. *Bulimulus Baroni.*
Fig. 9. *Oleacina Underwoodi.*

XIX.—*On some small Mammals from Salta, N. Argentina.*

By Oldfield Thomas.

Dr. C. Spegazzini, the well-known fungologist of La Plata, has been good enough to present for division between the Buenos Ayres and British Museums a small collection of Bats and Rodents made by him in Salta during the last southern summer season (Dec. 1896–Feb. 1897).

Among these specimens there are representatives of two new mice, now described, while the other species obtained also deserve some mention.

1. *Vespertilio*, sp.

a–c. Upper Cachi.
d. Viña.
e, *f*. Pampa Grande.

This fawn-coloured *Vespertilio* I can identify with no species contained in Dobson's Catalogue; but it may perhaps prove to be one of Azara's species, and I do not therefore care to describe it as new.

A full identification of Azara's bats and murines is very much needed before Argentine specimens, whether from the north or south, can be satisfactorily determined. Thanks to the collections made by Messrs. Perrens, Borelli, Spegazzini, and others, I hope soon to be in a position to publish an identification of all the species described by the Spanish author referred to.

* I take this opportunity of figuring some of the species described by me in this Magazine (ser. 6, vol. xviii., July 1896).

† Dr. Kobelt, in the Conch. Cab. ed. ii., *Helix*, p. 843, pl. xxviii. figs. 4–6, places this species in the subgenus *Bostryx*; he evidently did not read the original description or examine his specimen with a lens, as he makes no mention of the remarkable sculpture of the nucleus of *X. Baroni*, which separates it from *Bostryx* and other genera.

2. *Nyctinomus brasiliensis*, Geoff.

a–c. Cafayati, Salta.

It seems probable that this common bat is Azara's "Petite Chauve-souris obscure" (Chauve-souris neuvième), to which, fortunately, Geoffroy did not give a special name, referring it (wrongly) to his own *Molossus obscurus*. That Azara's bat was a *Nyctinomus* is clear from his statement that "La lèvre supérieure a des plis verticaux."

3. *Phyllotis griseoflavus*, Waterh.

a. Upper Cachi, Salta.

b. Lower Cachi.

This handsome rat was first recorded from the north (Jujuy) by Matschie, who was, however, naturally doubtful of its identity with a species described from such a distant locality as Rio Negro, Patagonia, the type locality of Waterhouse's animals. After the most careful comparison of these Salta examples with the type, and with a skin from Catamarca in the Museum collection, I am still of the opinion I expressed when Dr. Matschie's specimen was sent to London for examination, that the northern and southern forms cannot be separated.

Moreover, the examination of several recent collections shows that there is a most remarkable affinity between the faunas of the extreme north-west part of Argentina, including the neighbouring parts of Bolivia, even up to considerable altitudes, and that of North-eastern Patagonia, so far at least as Bahia Blanca and the Rio Negro are concerned. Thus I have lately seen a small collection from Bahia Blanca, and among them is a cavy which I cannot distinguish from *Cavia boliviensis*, Waterh., first described from the high land between Cochabamba and La Paz, Bolivia, while there is in the same collection an example of *Oryzomys laucha*, Desm., whose typical locality is Paraguay, but specimens of which were obtained by Dr. Borelli at Tala, Salta, and other localities in the present region. The Museum possesses both the cavy and the *Phyllotis* from Catamarca, and the Laucha has been taken all down the Parana to its mouth, where, at La Plata, I have found it abundant.

It would seem therefore that many of the Pampas animals extend north and south for a very great distance without any appreciable modification, ascending in the north to latitudes at which they no doubt find a very similar climate to that of the lowlands in the southern parts of their range. For this reason, when working out specimens coming from Bolivia, Argentina, or Patagonia, it must not be too

readily presumed that specimens from one end of the district are distinct as a matter of course from those described from the other—a presumption which, allowing for the great difference in altitude and position, would in other parts of America generally be quite justifiable.

4. *Akodon Spegazzinii*, sp. n.

a, *b*. Lower Cachi.
c. Pampa Grande.

A medium-sized *Akodon* of a generally fulvous colour, above and below.

Size rather smaller than *A. olivaceus*. Fur fairly long, soft and woolly; the underfur about 10 mm. long on the back. General colour dull grizzled fulvous rufous, quite unlike that of the greyish *Akodons* of the *olivaceus* group. Longer hairs as usual black. Fulvous body-colour clearer on sides, and passing almost unaltered on to the belly, which is scarcely lighter than the flanks; hairs round the anal region brighter fulvous. Throughout, above and below, the basal three fourths of the hairs are dark slate-coloured. Ears fairly large, rounded, laid forward in a spirit-specimen they reach about 2 millim. short of the posterior canthus; well clothed with short fulvous hairs. Hands and feet pale whitish fulvous above; claws long and strong, but not exaggerated as in the *A. megalonyx* group. Palms and soles naked, with the pads 5–6 as usual; fifth hind toe without claw reaching to the end of the first phalanx of the fourth. Mammæ 2—2=8. Tail rather long for an *Akodon*, finely haired, blackish above, yellowish white on the sides and below.

Skull strongly built, though the zygomata are not very widely expanded. Nasals long, rather narrow. Interorbital region smooth, slightly convex, its edges square but not ridged. Interparietal very small, narrow from before backwards, almost as broad laterally as in the middle line. Palatine foramina large and open, reaching backwards past the middle of m^1. Posterior narial fossa narrow, the palatal edge nearly a millimetre behind m^3.

Incisors dark orange above, pale yellowish below. Molars strictly Akodont.

Dimensions of the type, measured in spirit before skinning (female):—

Head and body 92 millim.; tail 71; hind foot, without claws, 20; ears 14. (The inclusion of the claws would increase the hind foot measurement by about 2·5 millim.)

Skull: basal length 22·5, basilar length from henselion 20·5; nasals 9·6×3; interorbital breadth 4·5; interparietal 7×1·4; palate length from henselion 11·3; diastema 7·2;

palatine foramina 5·8 × 2·1; length of upper molar series 4·3.

Type. B.M. no. 97.5.5.14, from Lower Cachi.

I can find no described species to which this mouse could be referred. In general colour it is more like one of the fulvous *Oryzomys* than an *Akodon*, but its teeth and proportions clearly show it to be a member of the latter group.

5. *Akodon albiventer*, sp. n.

a. Lower Cachi.

A medium-sized *Akodon* of a pale greyish colour, with a white belly.

Size rather less than in *A. Spegazzinii*. Fur little woolly, about 7 or 8 millim. long on the back. General colour pale grizzled greyish, the tips of the darker hairs brown, and of the paler ones whitish buff, all slaty grey basally. Under surface snowy white from chin to anus, fairly sharply separated from the dark of the upper surface, but the basal halves of the hairs are still slaty grey, although this colour is hidden by the white ends. Eyes with whitish rims. Ears rather shorter than in the last species, the anterior half of their outer side grizzled grey, the posterior half whitish; there are also a few whitish hairs forming an indistinct spot just behind them. Forearms, hands, and feet pure white; claws rather long, as in *A. Spegazzinii*; hind feet broad and heavy, the soles naked, with 6 elevated pads. Mammæ 2—2=8. Tail about as long as the body without the head, well-haired, brown above, white on the sides and below.

Skull not very unlike that of *A. Spegazzinii*. Nasals rather broader; interparietals still narrower, but markedly broader in the centre than at the sides; palatal foramina not extending to the middle of m^1, posterior nares broader, the palatal edge opposite the back of m^3.

Dimensions of the type, measured in spirit before skinning (female):—

Head and body 87 millim.; tail 67; hind foot 19·2; ear 12·5.

Skull: basal length 21·6; basilar length 20; greatest breadth 12·5; nasals 8·6 × 3·5; interorbital breadth 4·6; interparietal 6 × 1·2; palate length from hensilion 10·6; diastema 6·8; palatal foramina 5·4 × 1·8; length of upper molar series 4·3.

Type. B.M. no. 97.5.5.17.

This pretty little mouse may be readily distinguished from any of its allies, and especially from its neighbour *A. Spegazzinii*, by its pale grey back and snowy belly. In fact the colour-contrasts between these two species afford

an instance of the theory of "repulsion" (described P. Z. S. 1894, p. 144), by which when two allied species live together in the same place, and can gain no advantage by mutual resemblance ("mimicry"), they often intensify their colour differences to the greatest possible extent, in order probably that their members shall be enabled to distinguish comrades from rivals as readily as possible.

XX.—*Descriptions of Four new South-American Mammals.* By Oldfield Thomas.

Oxymycterus lanosus, sp. n.

General appearance exceedingly like that of *Akodon xanthorhinus*, Waterh. Fur very soft, thick, and woolly, the wool hairs about 9 millim. long on the back, and the longer straight hairs forming a thick fringe 5 or 6 millim. beyond the wool hairs. General colour deep yellowish olive all over above, the sides brighter yellow along the junction with the belly. Under surface slaty grey, the tips of the hairs buffy white. Ears small, not projecting above the fur, well haired. Upper surface of hands and feet shining white; pollex with a blunt claw, hardly long enough to be called a true claw, but longer and more compressed than a "nail." Fifth hind toe reaching to the middle of the basal phalanx of the fourth. Tail about as long as the body without the head, well haired, blackish brown above, yellowish white below and on the sides.

Skull with a narrow slender muzzle and a very large rounded brain-case. Nasals narrow, pointed, concave above when viewed in profile. Interorbital region broad, smoothly rounded, convex above, without ridges. Brain-case broad, flattened, rounded. Interparietal small. Anterior zygoma-root very narrow, slanted forwards. Anterior palatine foramina reaching back one third of the length of m^1; hinder edge of palate opposite back of m^3.

Incisors narrow, slender, very pale yellow above and white below. Molars as usual.

Dimensions of the type, in skin, male:—

Head and body (c.) 80 millim.; tail 51; hind foot (moistened) 20·6.

Skull: basilar length 18·4, greatest breadth (across brain-case) 12·4; nasals 9·3 × 2·8; interorbital breadth 4·8; palate length from henselion 9·9; diastema 6·1; palatal foramina 5·3 × 2; length of upper molar series 4.

Hab. Monteith Bay, Straits of Magellan.

Type. B.M. 80.7.28.11. Collected and presented by Dr. R. W. Coppinger, of H.M.S. 'Alert.'

The skin on which this species is founded is that mentioned under "*Hesperomys* (*Habrothrix*) *xanthorhinus*" in my account of the 'Alert' collections (P. Z. S. 1881, p. 5). That determination was based mainly on the spirit-specimen referred to at the same time, which is undoubtedly a true *Akodon* (=*Habrothrix*). A comparison of the skulls now shows not only that the two, like as they are externally, are different as species, but that the Monteith Bay skin belongs to the *Oxymycterus* group, as is especially shown by its narrow slanting zygoma-root, slender muzzle, and broad brain-case. In that group no species as yet described bears any resemblance to it.

Dasyprocta Kalinowskii, sp. n.

Size rather large. Fur ringed with black and yellowish rufous, the elongated hairs of the rump white with black tips, contrasting markedly with the rest of the body. Area round the root of tail black, abruptly defined from the white crest-hairs. Under surface yellowish, grizzled with brown. Feet blackish. Tail about an inch in length, naked.

Skull elongate, not unlike that of *D. variegata* and *fuliginosa*, but with the muzzle rather broader and more trumpet-shaped.

Dimensions of the type, an adult male :—

Head and body (measured in flesh by collector) 630 millim.; hind foot 125.

Skull: basilar length 89, greatest breadth 54; nasals 46 × 22; interorbital breadth 33·5; diastema 30; upper molar series 20·5.

Hab. Idma, Valley of Santa Ana, Cuzco, Peru. Alt. 4600 ft. Coll. J. Kalinowski, Nov. 2, 1894.

This handsome Aguti may be readily distinguished from any species hitherto described by the peculiar coloration of its long rump-hairs, which, white with black tips, are quite unlike those of any other species.

It was obtained by, and is named in honour of, Mr. J. Kalinowski, the well-known Polish collector, to whom science is already indebted for the discovery of so many interesting Peruvian mammals.

Peramys adustus, sp. n.

Size small. Fur close and short, only about 4 millim. long on the back. Colour all over above uniform finely grizzled brown, with a slight yellowish tinge; tip of muzzle blackish. Under surface coloured about as in *Mus musculus*; line of demarcation on sides little marked. Ears very short, practically naked. Hands and feet greyish brown, digits naked. Tail practically naked, its few fine hairs black.

Skull low and flattened. Nasals much expanded behind. Posterior lower premolar slightly smaller than the middle one.

Dimensions of the type, in skin :—

Head and body 100 millim. ; tail 53 ; hind foot (moistened) 15 ; ear (above head) (c.) 3.

Skull: basal length (c.) 25 ; nasals 12·5 × 4·5 ; interorbital breadth 6 ; breadth of brain-case 11 ; palate length 15 ; combined length of m^{1-3} 5·1. Lower jaw, condyle to tip of incisors 20·5 ; front of canine to back of m_4 12.

Hab. W. Cundinamarca, in the low-lying hot regions.

Type. B.M. 97.7.2.1.

This species has most resemblance in colour to *P. domesticus*, Wagn., but differs by its much smaller size and smaller ears. From the known species of its own size it is readily distinguishable by its uniform brownish coloration.

Ichthyomys trichotis, sp. n.

Size smaller than in the other species. Colour dark smoky or slaty grey all over above and below, with the exception of the chest and centre line of the belly, which are white. Ears short and narrow, their conch only standing up about 4 millim. above the crown, thickly clothed with hairs similar in colour and texture to those on the head, and of an equal length to that of the conch itself ; as a result the ears are quite lost among the general fur of the head. Upper surface of hands silvery white, of feet rather more brownish ; hind toes apparently rather less broadly webbed than in the other species, and the pads smaller and more distinctly defined. Tail about as long as the body without the head, well haired, blackish throughout except at the extreme tip, which, as in *I. hydrobates* and *Söderströmi*, is white.

Skull unfortunately too much broken in the only specimen to be described, and it can only be noted that the incisors, both above and below, are much thinner and narrower transversely and antero-posteriorly, and that the molars are of about the same size and proportions as those of *I. hydrobates*, or m^3 may be a little smaller.

Dimensions of the type, in skin :—

Head and body 130 millim. ; tail 114 ; hind foot 28·5 ; ear, above head, 4.

Skull : length of upper molar series 4·8, of lower molar series 4·9. Lower jaw, bone only, 13·5 ; to incisor tip 16·3.

Hab. W. Cundinamarca, in low country near to Magdalena R.

Type. B.M. 97.7.2.2.

This species resembles *I. hydrobates*, and, if really different,

I. Söderströmi, in the colour of its tail, but differs both from these and *I. Stolzmanni* by the extreme hairiness of its ears, the restriction of the white of the under surface to the chest and centre of belly, and by the slenderness of its incisors.

XXI.—*On the Anatomy of* Apera Burnupi, *E. A. Smith.*

By Walter E. Collinge, F.Z.S., Assistant Lecturer and Demonstrator in Zoology and Comparative Anatomy, Mason University College, Birmingham.

[Plate V.]

The genus of slugs known as *Apera* was originally constituted by Binney (2) in 1879 under the term *Chlamydephorus*. Heynemann (6), however, suggested the term *Apera*, on the ground that Binney's name indicated a false characteristic, viz. the presence of a mantle-lobe. Later, Mr. Edgar A. Smith (8) pointed out that Agassiz (1) had employed the term *Chlamydophorus*, which is practically the same as that used by Binney, for a group of mammals, a fact which Heynemann does not seem to have been aware of.

There are only two known species of this genus, namely, *A. Gibbonsi*, W. G. Binney, from Natal (2), and *A. Burnupi*, E. A. Smith, from Natal (8).

My best thanks are due to M. Edgar A. Smith, for his kindness in supplying me with the material upon which these observations on the anatomy have been made.

The specimen from which all the figures were drawn measured 49 millim. in length. It corresponded in all external features to the original description (8). Mr. Edgar A. Smith has pointed out that the carinæ are doubtless much accentuated in alcoholic specimens; this I can confirm, for on being immersed in very weak alcohol they were much less conspicuous, the dorsum being more convex. Mr. Smith has since sent me a note of some observations he made upon a living example, in which he points out that the keels are visible but less acute than in the contracted state. In Heynemann's figures (6, T. 2. figs. 5 & 6) of *A. Gibbonsi* the keel which limits the back is not shown. This same author (6, p. 19), although only acquainted with the external features of *A. Gibbonsi*, suggested that the genus *Apera* belonged to the Testacellidæ; on p. 19 he writes:—"Dann springt uns sofort die nahe Verwandtschaft mit *Testacella* in die Augen, die gemeinsame allgemeine Gestalt (s. Fig. von Gibbons), die gemeinsame Lage der Genital-, Athem- und Afteröffnung, die ähnliche strahlige Könnelung um diese Körperöffnung herum, die ähnliche Runzelung über die Länge des Rückens (s. Figur von Gibbons und seine

Beschreibung: 'Dorsum finely sulcato-striate from head to orifice. A row of small regular tubercles runs along medial line from head to prominence'), die Seltenheit des Vorkommens, die wohl in der gemeinsamen unterirdischen Lebensweise begründet ist, und dergl. mehr."

That *Apera* has affinities with the Testacellidæ there can be little doubt, but there is a wide gap between it and either *Testacella* or *Daudebardia*.

In the generalized character of the generative organs *Apera* resembles in some ways the genus *Schizoglossa*, but until we have a more detailed account of the anatomy of this last-named genus it will be difficult to rightly classify it. There is a still wider gap between *Apera* and *Schizoglossa* than between *Apera* and either *Testacella* or *Daudebardia*. Godwin-Austen (4, p. 8) has placed *Schizoglossa* with *Ælea* and *Paryphanta* in a new subfamily *Paryphantinæ*, on the following grounds:—"In the form of the buccal mass this new subgenus (*Schizoglossa*) shows best the close relationship which it has with *Paryphanta*, both in the rounded form of the basal end and in the unification of the salivary glands, neither of which characters are to be seen in *Testacella haliotidea* which I have examined . . . In the generative organs we find this difference, the vas deferens in *Testacella* joins the male organ near the attachment of the retractor muscle at the posterior end, whereas in *Paryphanta* and *Schizoglossa* it is peculiarly short and joins the male organ very low down just above the generative aperture."

Judging from Hedley's description and figure of the generative organs of *Schizoglossa* it would appear that we have here a mollusk in which numerous modifications have taken place. The absence of any receptaculum and the generalized character and feeble development of the male organs certainly make it difficult to rightly assign it to any family of mollusks where these are predominant features. There are not a few points in which it shows an affinity to *Apera*, and through this genus to *Testacella* and *Daudebardia*; at the same time there are many points of difference.

Anatomy.

The Alimentary Canal (Pl. V. fig. 2).—There is a wide buccal cavity from which passes a long thin-walled œsophagus; at the junction of the œsophagus with the crop is a large bilobed salivary gland, which pours its secretion into the postero-dorsal portion of the buccal cavity by a single duct. In *Testacella* there are two salivary glands and two ducts, lying on each side of the crop and opening laterally

into the anterior portion of the œsophagus. The crop is a wide thin-walled sac, rather longer than the œsophagus; the stomach, which forms the terminal portion of this sac, is a small bilobed cavity hidden in the substance of the liver. In *Schizoglossa*, Hedley (5, p. 390) remarks "that the pharynx is enormous, occupying almost the whole length of the visceral cavity, and nearly equalling in size the remainder of the viscera." I take it that what I am terming œsophagus and crop correspond to what Hedley terms pharynx; if so, the two forms closely agree in this feature. The intestine in *Schizoglossa* is short, while in *Apera* it makes two loops in the lobes of the liver, and terminates as a slightly wider tube, the rectum. In *Testacella* the intestine forms a single loop.

The Pedal Gland.—Opening beneath the mouth and occupying the floor of the visceral cavity for the whole length of the animal is a large thick-walled convoluted body, the pedal gland. It is wound from right to left, as shown in figure 3 (Pl. V.), and slightly indented on its upperside. It was of a yellowish brown in colour, its free end being much lighter and more glandular; to this there was a long muscle attached. In transverse section it appeared as shown in figure 4 (Pl. V.), viz. a small lumen on the underside, and in the mass of connective tissue &c. there were present a large series of microscopic chitinous (?) dart-like bodies. These had a broad and slightly convex plate-like form at the one end, tapering at the opposite end into a long fine point (Pl. V. fig. 5). The whole tube must contain many thousands of these bodies. I should have been glad to investigate the minute structure of this organ in greater detail had I possessed the material. In this example the gland had become exceedingly hard, almost brittle, with being in alcohol, and it was only after soaking in water for two or three days that I was able to make out the few features mentioned above.

Lacaze-Duthiers (7, p. 522) has described and figured the pedal gland in *Testacella*; it is simple in structure, much longer than in *Apera*, and exhibits the same zigzag form. In *Testacella* it is enclosed in a sheath of connective tissue, which I do not find in *Apera*. The cells of the gland are filled with granules; these probably represent what in *Apera* I have described as minute dart-like bodies. From the contracted state of the gland in the specimen I had, figure 4 probably only very incorrectly represents the actual appearance.

The Generative Organs.—There is a small vagina into which the penis opens. This latter organ is a narrow tube, slightly globose at the lower portion (Pl. V. fig. 6, *p.*), and a

short thin tube above (*v.d.*), which probably represents the vas deferens. In *Schizoglossa*, according to Hedley (5, p. 390), the penis is "represented by a slight bulbous swelling near the orifice, a vas deferens arising therefrom, and a short muscle attaches this swelling to the nearest point of the body-wall." In *Apera* there is a large and peculiarly shaped receptaculum seminis; its lower portion, forming the receptacular duct, opens into the vagina as a wide sac, above this it becomes narrowed, the receptaculum seminis here commencing and forming a large hook-shaped body (Pl. V. fig. 6, *r.s.*). The free oviduct is about the same length as the penis and vas deferens together, only slightly wider; it forms the direct continuation of the vagina (Pl. V. fig. 6, *f.ov.*). The common duct is of considerable length, much convoluted and folded upon itself. The albumen-gland is pyriform in shape and of median size. The hermaphrodite duct is a long tube slightly coiled in its upper portion. The hermaphrodite gland consists of a series of glandular clusters, the outer portions of which are villous (Pl. V. fig. 6, *h.gl.*).

References.

1. Agassiz, L. Nomenclator Zoologicus (Mammals), 1842.
2. Binney, W. G. "On the Jaw and Lingual Dentition of certain Terrestrial Mollusks." Bull. Mus. Comp. Zool. Camb., U.S.A., 1879, p. 331.
3. Collinge, Walter E. "The Morphology of the Generative System in the Genus *Testacella*." Ann. & Mag. N. H. 1893, vol. xii. pp. 21–25, pl. i.
4. Godwin-Austen, H. H. "On the Molluscan Genus *Paryphanta*, and on the Anatomy of *P. Hochstetteri*, Pfr." Proc. Malac. Soc. 1893, vol. i. pp. 5–9, pl. i.
5. Hedley, Charles. "*Schizoglossa*: a new Genus of Carnivorous Snails." Proc. Linn. Soc. N. S. W. 1892, vol. vii. pp. 387–392, pl. ix.
6. Heynemann, D. F. "Ueber *Chlamydephorus*, Binney." Jahrb. d. d. malak. Gesell. 1885, Jh. xii. pp. 17–20, T. 2.
7. Lacaze-Duthiers, H. de. "Histoire de la *Testacelle*." Arch. Zool. exp. et gén. 1887, t. v. pp. 458–596, pls. xxix.–xl.
8. Smith, Edgar A. "Description of a New Species of Slug from South Africa." Ann. & Mag. N. H. 1892, vol. x. pp. 465–466.
9. Wagner, A. J. "Die Arten des Genus *Daudebardia*, Hartmann, in Europa und Westasien." Denksch. Akad. Wiss. Wien, 1896, Bd. lxii. pp. 609–626, 5 pls.

EXPLANATION OF PLATE V.

Fig. 1. View of posterior portion of the dorsum of *Apera Burnupi*, E. A. S., showing dorsal opening.
Fig. 2. The alimentary canal, &c.
Fig. 3. The pedal gland, viewed from above.
Fig. 4. Transverse section of the same.

Fig. 5. Dart-like chitinous (?) bodies found in the walls of the pedal gland.
Fig. 6. The generative organs.

Lettering.

alb.gl. Albumen gland.	*p.* Penis.
b.c. Buccal cavity.	*pr.* Prostate.
c. Crop.	*r.d.* Receptacular duct.
f.ov. Free oviduct.	*rect.* Rectum.
h.d. Hermaphrodite duct.	*r.s.* Receptaculum seminis.
h.gl. Hermaphrodite gland.	*s.d.* Salivary duct.
int. Intestine.	*s.gl.* Salivary gland.
m. Muscle.	*st.* Stomach.
œ. Œsophagus.	*v.d.* Vas deferens.
ov. Oviduct.	*vg.* Vagina.

XXII.—*Description of a new* Papilio *from Bali of the* nox *group.* By Lionel de Nicéville, F.E.S., C.M.Z.S., &c.

The butterfly described below comes into Section B of the *nox* group of *Papilios* as defined by the Hon. Walter Rothschild in 'Novitates Zoologicæ,' vol. ii. p. 258 (1895), which is characterized by the margin of the abdominal fold of the hind wing in the male, when fully expanded, having a fringe of long hairs*; the basal partition of the subcostal nervure of the same wing in both sexes is short; and the abdomen in both sexes black, or red only at the apex. All the females of this section (except the species described below, which was unknown to Mr. Rothschild) are said by that writer to have the upperside of the fore wing "brown"; but *P. erebus*, Wallace, which I have from Sumatra only (it occurs also in the Malay Peninsula and in Borneo), certainly is dark blue-black as in *P. nyx*, and Westwood says the female of *P. erebus* is "black above"; while the latter eminent entomologist says also that his *P. strix*, which is the female of his *P. noctula*, is "black" above. I would reconstruct Mr. Rothschild's key to the females of the group (including *P. nyx*) as follows, adding that I have not seen specimens of *P. noctis* and *P. noctula*:—

A. Upperside, both wings brown.
  a. Upperside, hind wing uniform brown.
    1. *P. nox*, Swainson: Java.
  b. Upperside, hind wing with a band of dirty white near the outer margin.
    2. *P. noctis*, Hewitson: Borneo.

* Mr. Rothschild says his Section A also has a fringe of long hairs. This, however, is a clerical error; all the species in the Section lack these hairs.

B. Upperside, both wings blue-black.
  a. Upperside, hind wing strongly marked with longitudinal cream-coloured stripes on either side of the longitudinal black veins.
    3. *P. noctula*, Westwood: Borneo.
  b. Upperside, hind wing uniform blue-black.
    a'. Hind wing broad, deeply indented on the outer margin between the veins, with broad creamy-white cilia.
      4. *P. nyx*, de Nicéville: Bali.
    b'. Hind wing narrow, shallowly indented on the outer margin between the veins; the cilia just touched with white in the middle of the internervular indentations.
      5. *P. erebus*, Wallace: Malay Peninsula, Sumatra, Borneo.

* *Papilio* (*Pangerana*) *nyx*, sp. n.

Hab. Bali.

Expanse, ♀, 5·0 inches.

Female.—*Upperside*: both wings black, with a very slight blue gloss. Fore wing with the apex white, this white area bounded anteriorly by the second subcostal nervule, extending slightly into the anterior outer end of the discoidal cell, not reaching the apex and outer margin, and ending posteriorly about the third median nervule; this white area bears narrow streaks of the ground-colour between the veins; cilia creamy white. Hind wing unmarked; cilia broadly creamy white, this colour extending slightly on to the wing in the internervular indentations. *Underside*: both wings fuscous, without gloss. Fore wing with the white area more extensive, bounded anteriorly by the first subcostal nervule, and reaching nearer to the apex and outer margin; an obscure reddish streak on the middle of the costa anterior to the costal nervure; cilia creamy white. Hind wing unmarked; cilia creamy white, that colour extending much more broadly on to the wing than on the upperside, especially so on either side of the apices of the veins. Palpi, head and thorax at the sides, and abdomen at the apex crimson.

This species differs from the same sex of *P. erebus*, Wallace, in having the fore wing broader, the apical white area larger, the cilia creamy white instead of black, and the ground-colour less blue. The hind wing is markedly broader, the incisures much deeper, and the cilia broadly creamy white; in *P. erebus* the cilia are only just touched with white between the veins, otherwise black.

This interesting species was captured by Mr. William Doherty in March 1896, at 2000–4000 feet, in the island of Bali, which is only separated from Java on the east by a narrow strait. I am indebted to Mr. H. J. Elwes for the gift of the specimen described. He has doubtless other specimens in his collection.

Indian Museum, Calcutta,
May 22nd, 1897.

XXIII.—*Description of a new Ceratopterine Eagle-Ray from Jamaica.* By G. A. Boulenger, F.R.S.

Among some Fishes brought home from Jamaica by the Rev. J. Seed Roberts, who for many years has been paying special attention to the fish fauna of that colony, there was a Ceratopterine Ray which neither Mr. Roberts nor myself succeeded in identifying. It has much in common with Bancroft's *Cephalopterus hypostomus*, described from Jamaica in 1830, but is at once distinguished by the absence of teeth in the lower jaw, which precludes our referring it to the genus *Dicerobatis*, in which teeth are present in both jaws. The allied genus *Ceratoptera* agrees in this, that teeth are developed in one of the jaws only, but it is the lower instead of the upper that bears them; and, besides, the position of the mouth and the shape of the pectoral fin are entirely different. I therefore find myself compelled to propose a new genus for the reception of the Ray, with which I wish to associate the name of its discoverer.

Ceratobatis, gen. nov.

Like *Dicerobatis*, Blainv., but teeth restricted to the upper jaw.

Ceratobatis Robertsii, sp. n.

The band of teeth occupying only half the width of the mouth, its width 10 times in its length; teeth tessellated, hexagonal, 2 to 3 times as broad as long, rugose with numerous obtuse ridges. Mouth inferior, wide. Pupil vertically elliptic. Body smooth; pectoral fins with nearly straight, slightly convex anterior and slightly concave posterior border. Cephalic fins measuring a little less than the width of the mouth; spiracles behind the eyes. The space between the last branchial clefts one fourth that between the first. Dorsal fin between the ventrals. Tail slender, without spine, nearly twice as long as the body.

	millim.
Length of disk, without cephalic appendages	350
Width of disk	780
Cephalic fin	90
Width of mouth	105
Diameter of eye	12
Ventral fin	70
Tail	620

Black above, white beneath.

This Ray grows to a very large size; but specimens are almost impossible to obtain, owing to the superstitious fear of the fishermen. The single specimen secured by Mr. Roberts, the dimensions of which are recorded above, is a young one, and is now deposited in the British Museum.

XXIV.—*On Lepidoptera Heterocera from China, Japan, and Corea.* By John Henry Leech, B.A., F.L.S., F.Z.S., &c. —Part II. *Family* Geometridæ; *Subfamilies* Œnochrominæ, Orthostixinæ, Larentiinæ, Acidaliinæ, and Geometrinæ.

[Continued from p. 110.]

[Plates VII. & VIII.]

Subfamily *Geometrinæ*.

Genus Pseudoterpna.

(Hübn. Verz. p. 284; Hampson, Fauna Brit. Ind., Moths, iii. p. 472.)

Pseudoterpna superans.

Hypochroma superans, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 398 (1878); Ill. Typ. Lep. Het. iii. p. 36, pl. xlix. fig. 12 (1879).

There were some specimens from Nikko, Oiwake, and Yesso in Pryer's collection, and I took a few examples at Hakodate in August.

Hab. Japan and Yesso.

Pseudoterpna alba.

Pingasa alba, Swinh. Trans. Ent. Soc. Lond. 1891, p. 491, pl. xix. fig. 6.

Pseudoterpna alba, Hampson, Fauna Brit. Ind., Moths, iii. p. 474 (1895).

Six specimens from Gifu and one from Ningpo, the latter taken by a native collector in July.

Distribution. Khásis (*Hampson*); Japan; N. China.

Except that the ground-colour is tinged with ochreous, the Japanese and Chinese examples are identical with Indian specimens in the National Collection at South Kensington.

Pseudoterpna pseudoterpnaria.

Hypochroma pseudoterpnaria, Guen. Phal. i. p. 276 (1857).

Hypochroma Pryeri, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 398 (1878); Ill. Typ. Lep. Het. iii. p. 35, pl. xlix. fig. 9 (1879).

There were some fine specimens from Yokohama in Pryer's

collection, and I obtained the species at Nagasaki in June. I have also received it from Chia-kow-ho and the province of Kwei-chow.

Distribution. Japan; Western China.

Pseudoterpna pruinata.

Phalæna pruinata, Hufn. Berl. Mag. iv. pp. 5, 520 (1767).
Geometra cytisaria, Esp. Schmett. v. p. 242, pl. xliv. figs. 1–4; Hübn. Geom. pl. i. fig. 2.
Pseudoterpna pruinata, var. *simplex*, Alph. Rom. sur Lép. vi. p. 54 (1892).

Alphéraky records a form of this species from N.W. China under the varietal name *simplex*. He describes it briefly as a large greenish-white form without markings.

Distribution. Europe; Armenia; Western China.

Pseudoterpna sinapiaria.

Hypochroma sinapiaria, Pouj. Ann. Soc. Ent. Fr. 1895, p. 309, pl. vi. fig. 5.

Poujade records a female specimen from Moupin.

Hab. Western China.

Pseudoterpna Davidaria.

Pachyodes Davidaria, Pouj. Ann. Soc. Ent. Fr. 1895, p. 310, pl. vii. figs. 16, 16 *a*.

One female specimen from Moupin (*Poujade*).

Hab. Western China.

Pseudoterpna arenaria.

Pachyodes arenaria, Leech, Trans. Ent. Soc. Lond. 1889, p. 144, pl. ix. fig. 12.

One female specimen from Kiukiang, taken in June.

Hab. Central China.

Pseudoterpna dorsocristata.

Terpna dorsocristata, Pouj. Ann. Soc. Ent. Fr. 1895, p. 313, pl. vii. figs. 18, 18 *a*.

Poujade's type (a female) was from Moupin.

I received a male specimen from Chang-yang, taken in July.

Hab. Central and Western China.

The male antennæ are slightly serrated.

Genus Actenochroma.

(Warren, Proc. Zool. Soc. Lond. 1893, p. 350.)

Actenochroma virescens.

Bylazora virescens, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 398 (1878); Ill. Typ. Lep. Het. iii. p. 35, pl. xlix. fig. 8 (1879).

There was one example of each sex from Gifu in Pryer's collection. Butler's type was from Hakodate.

Hab. Japan and Yesso.

Genus Archæopseustes.

(Warren, Novit. Zool. i. p. 380 (1894).)

Archæopseustes amplificata.

Abraxas amplificata, Walk. Cat. Lep. Het. xxiv. p. 1124 (1862).
Archæopseustes amplificata, Warr. Novit. Zool. i. p. 380 (1894).

I received two male specimens and a female from Kiukiang, two males from Ichang, and one male from Omei-shan: June and July.

Walker's type was from N. China.

Hab. North, Central, and Western China.

Archæopseustes leucomelanaria.

Pachyodes leucomelanaria, Pouj. Ann. Soc. Ent. Fr. 1895, p. 311, pl. vii. fig. 17.

Poujade's type was from Moupin. I have a male specimen, taken in July, from the same locality.

Hab. Western China.

Genus Limbatochlamys.

(Rothschild, Novit. Zool. i. p. 540 (1894).)

Limbatochlamys Rosthorni.

Limbatochlamys Rosthorni, Rothschild, Novit. Zool. i. p. 540, pl. xii. fig. 9 (1894).

I have one male specimen from Chang-yang and one from Moupin: July.

The type is referred to as from "Interior of China (probably districts west of Ichang)."

Hab. Central and Western China.

Genus Chlorodontopera.

(Warren, Proc. Zool. Soc. Lond. 1893, p. 351.)

Chlorodontopera robustaria.

Hemithea robustaria, Guen. Phal. i. p. 383 (1857).

Thalassodes mucrataria, Walk. Cat. Lep. Het. xxvi. p. 1561 (1862).
Chlorodontopera robustaria, Hampson, Fauna Brit. Ind., Moths, iii. p. 484 (1895).

Specimens in Pryer's collection without locality. I captured examples at Gensan in July and I received a female specimen from Wa-shan, taken in June.

Distribution. Japan; Corea; Western China.

Chlorodontopera mandarinata.

Chlorodontopera mandarinata, Leech, Trans. Ent. Soc. Lond. 1889, p. 141, pl. ix. fig. 13.

One example from Kiukiang, May.

Hab. Central China.

Genus Agathia.

(Guen. Phal. i. p. 380 (1857).)

Agathia lætata.

Agathia carissima, Butl. Ill. Typ. Lep. Het. ii. p. 50, pl. xxxvi. fig. 7 (1878).
Agathia lacunaria, Hedem. Horæ Ent. Ross. xiv. p. 512, pl. iii. fig. 4 (1879).
Agathia lætata, Fabr., Hampson, Fauna Brit. Ind., Moths, iii. p. 487 (1895).

There was a specimen from Yokohama in Pryer's collection, and my native collector obtained one in the island of Kiushiu. I took the species at Gensan in July, at Sakata and Hakodate in August, and I have received examples from Ichang, Moupin, Ni-tou, Huang-mu-chang, and Chia-kou-ho, all taken in July.

Distribution. Askold; Siberia; throughout India, Ceylon, and Burma; Borneo; New Guinea; Australia (*Hampson*); Corea; Japan; Yesso; Kiushiu; Central and Western China.

Agathia lycœnaria.

Geometra lycœnaria, Koll. Kasch. iv. p. 486 (1848).
Agathia lycœnaria, Guen. Phal. i. p. 380 (1857); Hampson, Fauna Brit. Ind., Moths, iii. p. 485 (1895).

One specimen from Huang-mu-chang, July.

Distribution. Throughout India, Ceylon, and Borneo; Penang; Java (*Hampson*); Western China.

Genus Uliocnemis.

(Warr. Proc. Zool. Soc. Lond. 1893, p. 355.)

Uliocnemis cassidara.

Phorodesma cassidara, Guen. Phal. i. p. 370 (1857).

Comibæna biplagiata, Moore, Lep. Ceyl. iii. p. 435 (1887); Hampson, Ill. Het. ix. p. 145, pl. clxxvi. fig. 18 (larva).
Uliocnemis cassidara, Hampson, Fauna Brit. Ind., Moths, iii. p. 488 (1895).

One specimen from Huang-mu-chang, July.
Distribution. Ceylon (*Hampson*); Western China.

Uliocnemis albimarginata.

Uliocnemis albimarginata, Warren, Proc. Zool. Soc. Lond. 1893, p. 353 Hampson, Fauna Brit. Ind., Moths, iii. p. 489 (1895).

Distribution. Sikhim; Japan (*Hampson*).
Warren described this species from Sikhim. I do not know the Japanese form of it.

Uliocnemis venata.

Thalera venata, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 437 (1879).

There were three specimens from Yokohama in Pryer's collection.
Hab. Japan.

Genus Hemithea.

(Dup.; Hampson Fauna Brit, Ind., Moths, iii. p. 490 (1895).)

Hemithea strigata.

Geometra strigata, Müll. Fauna Ins. Friedr. p. 51 (1864).
Geometra æstivaria, Esp. v. pl. ii. figs. 1–3; Hübn. Geom. fig. 9; Treit. Schmett. v. 1, 117.
Hemithea æstivaria, Dup. Lép. vii. pl. cli. fig. 6.
Hemithea thymiaria, Guen. Phal. i. p. 384.
Nemoria strigata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 94.

I took specimens in Satsuma in May, at Fusan and Gensan in July, and my native collector at Hakodate in August.
Distribution. Europe; Amur; Corea; Japan; Yesso; Kiushiu.

Hemithea unilinearia, sp. n.

Bluish green, costa of primaries marked with blackish. All the wings have a fine whitish transverse line beyond the middle; this line is more wavy on the secondaries than on primaries: primaries have a black discal dot. Fringes greyish green. Under surface whitish green.
Expanse 38 millim.
One male specimen from Pu-tsu-fong, July.
Hab. Western China.

Hemithea obliterata.

Nemoria obliterata, Walk. Cat. Lep. Het. xxvi. p. 1558 (1862).
Iodis ussuriaria, Brem. Lep. Ost-Sib. p. 77, pl. vi. fig. 24 (1864).
Nemoria ussuriaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 94.

One male specimen from Oiwake in Pryer's collection. Walker's type was from Shanghai.

Distribution. E. Siberia; Amur; Japan; Eastern China.

Hemithea mundaria, sp. n.

Light yellowish green. Primaries have two whitish transverse lines on the central area of the wing, the first outwardly edged with green of a darker shade than the ground-colour and curved below costa, the second inwardly edged with the darker colour and more or less undulated. Secondaries have a discal mark agreeing in colour with the edgings of the transverse lines and a continuation of the second line of primaries. Under surface greenish white.

Expanse 26 millim.

Two male specimens and one female from Ta-chien-lu, June.

Hab. Western China.

Hemithea marina.

Thalassodes marina, Butl. Ann. & Mag. Nat. Hist. (5) i. p. 399 (1878); Ill. Typ. Lep. Het. iii. p. 37, pl. l. fig. 1 (1879).
Euchloris putata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 95.

A series from Yokohama in Pryer's collection.

I obtained specimens at Tsuruga and Gensan in July.

Pryer considered this species to be identical with *Iodis lactearia* from Europe.

Distribution. Corea; Japan.

Genus TANAORRHINUS.

(Butl. Ill. Typ. Lep. Het. iii. p. 38 (1879).)

Tanaorrhinus reciprocatus.

Geometra reciprocata, Walk. Cat. Lep. Het. xxii. p. 515 (1861).
Geometra confuciaria, Walk. *l. c.* p. 522.
Tanaorhinus confuciaria, Butl. Ill. Typ. Lep. Het. iii. p. 38, pl. l. fig. 4 (1879).
Tanaorrhinus reciprocatus, Hampson, Fauna Brit. Ind., Moths, iii. p. 493 (1895).

A few specimens from Tokio and Kanosan in Pryer's collection.

I captured the species at Nagasaki in May, and Mr. Smith obtained it at Hakone in August.

I have also received examples from Chang-yang, Kiukiang, and the Province of Kwei-chow, taken in July.

Distribution. Simla; Dharmsala; Sikhim; Khásis (*Hampson*); North, Central, and Western China; Japan.

Tanaorrhinus vittatus.

Geometra vittata, Moore, Proc. Zool. Soc. Lond. 1867, p. 636; Waterhouse, Aid, pl. cli. fig. 5 (1884).
Tanaorrhinus prasinus, Butl. Ann. & Mag. Nat. Hist. (5) iv. p. 438 (1879).
Tanaorrhinus vittatus, Hampson, Fauna Brit. Ind., Moths, iii. p. 494 (1895).

Some specimens from Yokohama in Pryer's collection.

I met with the species at Nagasaki in May, and Mr. Smith obtained it at Hakone in August.

I have received examples from Omei-shan and the Province of Kwei-chow.

Distribution. N.W. Himalayas; Sikhim; Khásis (*Hampson*); Japan; Kiushiu; Western China.

Genus Geometra.

(Linn. Syst. Nat.; Hampson, Fauna Brit. Ind., Moths, iii. p. 495 (1895).)

Geometra papilionaria.

Phal. Geometra papilionaria, Linn. Syst. Nat. x. p. 522.
Geometra papilionaria, Esp. v. pl. vi. figs. 1–4; Hübn. Geom. fig. 6.
Holothalassis papilionaria, Hübn. Verz. Schmett. p. 285.

Some fine specimens from Oiwake and Yesso in Pryer's collection. I took the species at Hakodate in July.

Distribution. Europe; Siberia; Amur; Japan; Yesso.

Geometra flavifrontaria.

Nemoria flavifrontaria, Guen. Phal. i. p. 346 (1857).
Loxochila mutans, Butl. Proc. Zool. Soc. Lond. 1881, p. 615.
Geometra flavifrontaria, Hampson, Fauna Brit. Ind., Moths, iii. p. 496 (1895).

One example from Ichang, June.

Distribution. N.W. Himalayas; Central China.

Genus Aracima.

(Butl. Ill. Typ. Lep. Het. ii. p. 50 (1878).)

Aracima muscosa.

Aracima muscosa, Butl. Ill. Typ. Lep. Het. ii. p. 51, pl. xxxvi. fig. 8 (1878).
Geometra (?) *vestita*, Helem. Horæ Ross. xiv. p. 508, pl. iii. fig. 3 (1879).
Geometra muscosa, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 96.

Several specimens from Yokohama in Pryer's collection.

Mr. Smith took the species at Hakone in August, and I captured some examples at Tsuruga in July and at Nikko in September.

A fairly constant species, but the discal markings of all the wings and the marginal border of secondaries are subject to modification.

Distribution. Amur; Japan.

Genus MEGALOCHLORA.

(Meyrick, Trans. Ent. Soc. Lond. 1892, p. 95.)

Megalochlora sponsaria.

Chlorochroma sponsaria, Brem. Lep. Ost-Sib. p. 77, pl. vi. fig. 25 (1864).
Megalochlora sponsaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 95.

Specimens from Yokohama and Oiwake in Pryer's collection.

Distribution. E. Siberia; Amur; Japan.

Geometra viridescentaria, Motsch., is probably identical with this species.

Megalochlora albovenaria.

Geometra albovenaria, Brem. Lep. Ost-Sib. p. 75, pl. vi. fig. 21 (1864).
Megalochlora albovenaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 95.
Geometra valida, Feld. Reise Nov. v. pl. cxxvii. fig. 37 (1875).
Geometra dioptasaria, Christ. Bull. Mosc. 1880, p. 9.

There were some examples from Yokohama in Pryer's collection. I obtained specimens at Gensan in June and July; and have received specimens from Omei-shan, Wa-shan, and Che-tou, taken in June and July.

Distribution. E. Siberia; Amur; Japan; Corea; Western China.

Megalochlora mandarinaria, sp. n.

Pale bluish green. Primaries, which are slightly concave below apex, have two transverse whitish lines, the first curved below costa and the second broad and slightly oblique; there is a whitish line at end of the cell. Secondaries, which are angled in middle of outer margin, have a broad oblique whitish line. Fringes whitish. Under surface whitish, strongly tinged with green on primaries; the broad transverse lines of upper surface are reproduced.

Expanse 54 millim.

One male specimen from Chow-pin-sa, taken in June.

Hab. Western China.

This species is somewhat similar to *M. albovenaria*, Brem., but the outer margins are not crenulate.

Megalochlora glaucaria.

Geometra glaucaria, Mén. Bull. de l'Acad. xvii. p. 220; Schrk. Amur-Reis. p. 65, pl. v. fig. 8 (1859).
Geometra usitata, Butl. Ill. Typ. Lep. Het. ii. p. 49, pl. xxxvi. fig. 3 (1878).
Megalochlora glaucaria, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 95.

Some specimens from Yokohama and Oiwake in Pryer's collection.

Distribution. Amur; Japan.

Genus Euchloris.

(Hübn.; Meyrick, Trans. Ent. Soc. Lond. 1892, p. 94.)

Euchloris insolitaria, sp. n.

Male.—Bluish green; all the wings have a whitish transverse line beyond the middle, that on primaries is almost straight and that on secondaries slightly angled about the middle. Fringes whitish chequered with brown. Under surface whitish tinged with green.

Expanse 43 millim.

One male specimen taken by myself in the Province of Satsuma in May, and a female from Chang-yang, Central China, captured in June.

The female has plain fringes, but otherwise agrees with the male.

Distribution. Kiushiu; Central China.

Euchloris difficta.

Comibæna difficta, Walk. Cat. Lep. Het. xxii. p. 576 (1861); Butl. Ill. Typ. Lep. Het. iii. p. 37, pl. l. fig. 3 (1879).
Ochrognesia difficta, Warren, Novit. Zool. i. p. 391 (1894).

There were specimens from Ohoyama and Nikko in Pryer's collection, and my native collector took a few examples at Gensan in July; I have two from Chang-yang and one from Ichang, taken in July.

Warren considers "*Phorodesma*" *gratiosaria*, Brem., from East Siberia to be identical with *E. difficta*.

Distribution. North and Central China; Japan; Corea; East Siberia.

Euchloris albocostaria.

Euchloris albocostaria, Brem. Lep. Ost-Sib. p. 76, pl. vi. fig. 22 (1864).

There were specimens from Nikko in Pryer's collection.

I obtained the species at Gensan in July and have received it from Ichang.

Distribution. E. Siberia; Amur; Japan; Corea; Central China.

Euchloris procumbaria.

Euchloris procumbaria, Pryer (W. B.), Cist. Ent. ii. p. 232, pl. iv. fig. 2 (1877).
Comibæna vaga, Butl. Trans. Ent. Soc. Lond. 1881, p. 410.

One female specimen from Nikko in Pryer's collection; and a male from Omei-shan, taken in June. Butler's type was from Tokio and that of Pryer from Shanghai.

Distribution. Japan; Western China.

Euchloris argentataria, sp. n.

Bright green. Primaries have two silvery-white lines, the first forming a double curve, the second dentate towards costa and expanding into a broad dentate mark above inner margin; the marginal area is washed with silvery white and there is a patch of purplish grey enclosing two black dots on the inner marginal portion; discal dot encircled with white. Secondaries have an elongate purplish discal mark and a silvery-white marginal line, this latter is inwardly dentate above the middle, arcuate towards the purplish-grey outer angle, and expands into a purplish-grey marked blotch at anal angle. Fringes silvery white, mixed with purplish grey on the secondaries. Under surface: primaries green as above, marked with silvery white on inner marginal area and on the outer margin; outer line and discal dot as above: secondaries silvery white, with a blackish patch at outer angle, a blackish discal dot, and a fuscous wavy line beyond.

Expanse 28 millim.

Two male specimens were taken by my native collector at Gensan in July, and he also obtained one example in the island of Kiushiu. Mr. Smith captured a male at Hakone in August, and I have received one from Chang-yang that was taken in May.

Distribution. Corea; Kiushiu; Central China.

Euchloris nigromacularia, sp. n.

Bright green. Primaries have the costa white and two white angulated transverse lines; the second line is followed on the inner margin by a ferruginous more or less quadrate patch; submarginal line white, interrupted. Secondaries have a blackish patch at outer angle extending along margin to third median nervule, this is limited by a white line which becomes broader below third median nervule and expands

into a pale ferruginous tinged patch at anal angle. Fringes pale greyish preceded by a series of black dots, these dots are largest on the secondaries and at inner angle of primaries; all the wings have a black discal dot. Under surface white, tinged with green on the primaries: secondaries have a black patch on outer margin interrupted by the nervules; discal dots as above.

Expanse 40 millim.

One female specimen from Chow-pin-sa, taken in June; and there was an example of the same sex in Pryer's collection, probably from Yokohama.

Distribution. Western China; Japan.

Euchloris ornataria, sp. n.

Bright green, striated with silvery white. Primaries have two silvery-white transverse lines, the first is slightly curved and the second is oblique and slightly undulated; there is a short upright violet bar on inner margin before angle, and a patch of the same colour at anal angle of secondaries; all the wings have a black discal dot. Fringes: of primaries whitish tinged with greenish, except at inner angle where they are violet; of secondaries violet, preceded by a blackish line below outer angle, thence by black dots on the nervules. Under surface whitish, tinged with green, especially on primaries; discal dots as above; violet markings faintly reproduced.

Expanse 32 millim.

Six male specimens from Pu-tsu-fong, taken in June.

Hab. Western China.

Euchloris obsoletaria, sp. n.

Green. Primaries have the costa white and two obscure whitish transverse lines, the first slightly curved and the second elbowed below the costa and indented above inner margin; all the wings have a blackish discal dot. Fringes whitish grey, preceded by a violet-brown line. Under surface: of primaries green, washed with whitish on the inner marginal area, with black discal dot and pale central line; of secondaries whitish, with a black discal dot and dusky greenish central line.

Expanse 32 millim.

One female specimen from the island of Kiushiu, and one taken by myself at Nagasaki in June.

Hab. Kiushiu.

Euchloris incomptaria, sp. n.

Pale bluish green without transverse lines. Primaries whitish on costa; there is a short upright violet-grey bar at inner angle and a patch of the same colour on outer angle of secondaries; outer marginal line of all the wings violet-grey. Under surface whitish with a faint greenish tinge; violet-grey markings faintly reproduced.

Expanse 33 millim.

One male specimen, without fringes to the wings, from Wa-shan, taken in July.

Hab. Western China.

Euchloris chlorophyllaria.

Phorodesma chlorophyllaria, Hedem. Horæ Soc. Ent. Ross. xiv. p. 510, pl. iii. fig. 7 (1878); Alph. Rom. sur Lép. vi. p. 53 (1892).
Phorodesma jankowskiaria, Mill.; Oberth. Etud. d'Entom. v. p. 47, pl. iv. fig. 7 (1880).

Alphéraky records this species from the Province of Kansou, July.

I received a male specimen from Pu-tsu-fong, taken in June or July.

Distribution. Amur; Askold; Western China.

Euchloris simpliciaria, sp. n.

Pale bluish green, with whitish fringes and a dusky discal dot on all the wings; the fringes are preceded by a dark line. Under surface whitish tinged with greenish, discal dots as above.

Expanse 30 millim.

One female specimen from Chang-yang, taken in August.

Hab. Central China.

Euchloris striataria, sp. n.

Pale green, striated with silvery white; costa of primaries whitish. Fringes whitish. Under surface whitish, slightly tinged with fuliginous on basal portion of costa.

Expanse 31 millim.

One female specimen from Che-tou, taken in July.

Hab. Western China.

Euchloris subtiliaria.

Euchloris subtiliaria, Brem. Lep. Ost-Sib. p. 76, pl. vi. fig. 23 (1864).
Racheospila nympha, Butl. Trans. Ent. Soc. Lond. 1881, p. 411.

Several specimens from Yokohama, Gifu, and Yesso in Pryer's collection.

I met with this species at Nikko in September, and my native collector obtained it in June at Ningpo and also in the island of Kiushiu.

I received examples from Moupin, Wa-ssu-kow, Chow-pin-sa, Wa-shan, and Che-tou, taken in June and July.

Distribution. Dharmsála; Sikhim; Nilgiris; Ceylon; Australia (*Hampson*); Amur (*Græser*); E. Siberia; Japan; Yesso; Kiushiu; Western China.

Euchloris radiata.

Thetidea (?) *radiata*, Walk. Cat. Lep. Het. xxvi. p. 1567 (1862).
Euchloris radiata, Hampson, Fauna Brit. Ind., Moths, iii. p. 498 (1895).

One female specimen from Huang-mu-chang, taken in July.

Distribution. Kulu; Dharmsála (*Hampson*); Western China.

Genus Colutoceras.

(Warren, Novit. Zool. ii. p. 88 (1895).)

Colutoceras diluta.

Colutoceras diluta, Warren, Novit. Zool. ii. p. 88 (1895).

Warren describes one male specimen from Kiushiu.

The insect I have described as *Euchloris obsoletaria* may possibly be the female of this.

Genus Nemoria.

(Hübn.; Hampson, Fauna Brit. Ind., Moths, iii. p. 501 (1895).)

Nemoria viridaria.

Phal. Geometra viridata, Linn. Fauna Suec. 330.
Geometra viridata, Hübn. Geom. fig. 11; Treit. Schmett. vi. 1, 107; Dup. Lép. vii. pl. cli. fig. 4.
Nemoria viridaria, Hübn. Verz. Schmett. p. 285; Guen. Phal. i. p. 346; Meyrick, Trans. Ent. Soc. Lond. 1892, p. 94.

I took one specimen at Gensan in July, and I have received specimens from Chang-yang and Moupin which appear referable to this species.

Distribution. Europe; Altai; Amur; Corea; Central and Western China.

Nemoria gelida.

Nemoria gelida, Ill. Typ. Lep. Het. vii. p. 104, pl. cxxxvi. fig. 5 (1889).

One specimen from Huang-mu-chang, July.

Distribution. Dalhousie; Kulu; Dharmsála (*Hampson*); Western China.

Nemoria rectilinearia, sp. n.

Whitish green. Primaries have an almost straight whitish transverse line before the middle and an oblique one beyond the middle; the latter is continued on the secondaries. Fringes whitish, tinged with greenish. Under surface whitish, tinged with green; area beyond the whitish transverse line paler.

Expanse 24 millim.

Several examples of each sex from Huang-mu-chang, July.

Hab. Western China.

Allied to *N. indecretata*, Walk., but the line on secondaries is straighter and terminates nearer the anal angle, and the costa of primaries is pale brown.

Genus THALASSODES.

(Guen. Phal. i. p. 359; Meyrick, Fauna Brit. Ind., Moths, p. 507 (1895).)

Thalassodes gavissima.

Comibæna gavissima, Walk, Cat. Lep. Het. xxii. p. 575 (1861).
Berta gavissima, Moore, Lep. Ceyl. iii. p. 435, pl. cxcvi. fig. 6 ♂ (1887).
Thalassodes gavissima, Hampson, Fauna Brit. Ind., Moths, iii. p. 510 (1895).

One specimen from Wa-shan, June.

Distribution. Simla; Sikhim; Ceylon (*Hampson*); Western China.

Thalassodes vallata.

Thalassodes vallata, Butl. Ill. Typ. Lep. Het. ii. p. 50, pl. xxxvi. fig. 9 (1878); Hampson, Fauna Brit. Ind., Moths, iii. p. 514 (1895).

Several specimens from Yokohama in Pryer's collection.

I met with this species at Nagasaki in May, Fushiki and Gensan in July, and at Hakodate in August.

Distribution. Sikhim; Khásis (*Hampson*); Japan; Kiushiu; Yesso; Corea.

Thalassodes parallelaria, sp. n.

Similar to *T. vallata*, Butl., but rather lighter green in colour. The first line of primaries approaches the second on the inner margin, and the latter is parallel with outer margin; both lines are white and without inward shading; the costa is narrowly whitish and immaculate. The transverse line of secondaries is also white and terminates nearer the middle of abdominal margin than the anal angle. Fringes white,

marked with rufous brown at angle of secondaries, and not preceded by a brown line.

Expanse 36 millim.

One male specimen from Moupin and one from Ni-tou, July.

Hab. Western China.

Thalassodes inconcinnaria, sp. n.

Green; all the wings have two obscure, wavy, whitish transverse lines, that on primaries beyond the middle is rather oblique. Fringes whitish tinged with green. Under surface paler than above and without transverse lines.

Expanse 33 millim.

One male specimen from Ta-chien-lu and one from Pu-tsu-fong, both taken in June.

Hab. Western China.

Thalassodes submacularia, sp. n.

Darkish olive-green, costa of primaries brownish marked with darker. All the wings have a darker, wavy, transverse line beyond the middle, and a dusky discal mark; the line on secondaries has a bidentate projection below the middle. Fringes of primaries brown, and those of secondaries pale brown dotted with darker above the angle, which is strongly produced. Under surface greenish white, with a large blackish patch at inner angle of primaries and outer angle of secondaries.

Expanse 41 millim.

One male specimen from Moupin and a female from Omei-shan, both taken in June.

Hab. Western China.

Thalassodes thetydaria.

Iodis thetydaria, Guen. Phal. i. p. 358 (1857).
Thalassodes bifasciata, Walk. Cat. Lep. Het. xxvi. p. 1562 (1862).
Thalassodes thetydaria, Hampson, Fauna Brit. Ind., Moths, iii. p. 509 (1895).

One male specimen from Che-tou and a female from Moupin, June and July.

Distribution. Sikhim; Sylhet (*Hampson*); Western China.

Thalassodes albistrigata.

Gelasma albistrigata, Warren, Novit. Zool. ii. p. 89 (1895).

Warren describes this species from Japan. I have not obtained any specimens of it.

Hab. Japan.

Genus Thalera.

(Hübn. ; Hampson, Fauna Brit. Ind., Moths, iii. p. 514 (1895).)

Thalera fimbrialis.

Phalæna fimbrialis, Scop. Ent. Carn. p. 216 (1763).
Geometra bupleuraria, Hübn. Geom. fig. 8.
Thalera bupleuraria, Hübn. Verz. Schmett. p. 285.

I took one male specimen at Gensan in July.
Distribution. Europe ; Asia Minor ; Amur ; Corea.

Thalera rufolimbaria.

Thalera rufolimbaria, Heyden. Mem. Ross. xiv. p. 512, pl. iii. fig. 5 (1878).
Thalera crenulata, Butl. Ill. Typ. Lep. Het. iii. p. 37, pl. l. fig. 2 (1879).

There was a nice series in Pryer's collection from Yokohama and Yesso. I obtained the species in Satsuma in May, at Nagasaki and Fusan in June, and at Shimonoseki and Tsuruga in July. My native collector took it in the island of Kiushiu in July. I have also received specimens from Chang-yang, Ichang, Moupin, Pu-tsu-fong, and Huang-mu-chang.

The Japanese examples range in expanse from 22 millim. (♂) to 30 millim. (♀). A series taken at Chang-yang, Central China, in June, average 25 millim. in expanse, whilst the specimens taken at Ichang, Central China, in August, measure 2 millim. less in expanse.

Distribution. Amur; Japan; Yesso; Kiushiu; Central and Western China.

Thalera putata.

Phal. Geometra putata, Linn. Syst. Nat. x. p. 523 ; Clerck, Icon. pl. iii. fig. 9.
Geometra putataria, Hübn. Geom. fig. 10.
Iodis putataria, Hübn. Verz. Schmett. p. 286 ; Guen. Phal. i. p. 557.
Euchloris putata, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 95.

This species seems to be generally distributed throughout Japan from May to August. I have also taken specimens at Gensan and in the island of Kiushiu. All are rather darker in colour than European examples.

Distribution. Europe ; Japan ; Corea ; Kiushiu.

Thalera prærupta.

Thalassodes prærupta, Butl. Ill. Typ. Lep. Het. ii. p. 49, pl. xxxvi fig. 5 (1878).

The type of this species was taken at Yokohama by Mr. Jonas.

Hab. Japan.

Thalera lactearia.

Phal. Geometra lactearia, Linn. Syst. Nat. x. p. 519; Clerck, Icon. pl. iii. fig. 12.
Iodis lactearia, Guen. Phal. i. p. 355.
Euchloris lactearia, Meyrick, Trans. Ent. Soc. Lond. 1892, p. 95.

There was one example from Yesso in Pryer's collection mixed up with *Hemithea marina*, Butl., and I took a specimen at Gensan in June and at Ningpo in April. My native collector obtained the species at Ningpo in June.

Distribution. Europe; Amur; Corea; Yesso; Eastern China.

Thalera ambigua.

Thalassodes ambigua, Butl. Ill. Typ. Lep. Het. ii. p. 49, pl. xxxvi. fig. 6 (1878).

Specimens from Oiwake in Pryer's collection. I obtained specimens at Nagahama in July, and my native collector at Gensan also in July.

Distribution. Corea; Japan; Kiushiu; Ningpo.

Thalera sinuosaria, sp. n.

Green, each wing with two sinuous darker lines, the first edged inwardly with whitish, the second edged outwardly, expanding about the middle and above inner margin on primaries and before abdominal margin on secondaries; all the wings have a dark discal ring centred with white. Fringes slightly paler than the ground-colour and preceded on the secondaries by a darker line. Under surface silky white, the primaries tinged with greenish.

Expanse 28–34 millim.

Four examples of each sex.

Ta-chien-lu, Moupin, Pu-tsu-fong, Wa-shan, Omei-shan, and Ni-tou: June.

Hab. Western China.

Thalera flagellaria.

Hemithea flagellaria, Pouj. Ann. Soc. Ent. Fr. 1895, p. 310, pl. vi. fig. 8.

Two male specimens from Moupin (*Poujade*). I have received specimens from Ta-chien-lu, Ni-tou, Moupin, and Chang-yang: June, July, and August.

Hab. Central and Western China.

Thalera protrusa.

Thalera protrusa, Butl. Ill. Typ. Lep. Het. ii. p. 50, pl. xxxvi. fig. 10 (1878).

Four examples from Yokohama? in Pryer's collection. I captured a specimen at Fusan in June.

Hab. Japan and Corea.

Thalera colataria, sp. n.

Pale olive-green. Primaries have two wavy, whitish, transverse lines, the outer continued on the secondaries; there is an elongate discal mark on each wing. Under surface whitish, tinged with green. Fringes whitish, chequered with fuscous and preceded by a fuscous line. Outer margin of the wings crenulate, especially of secondaries, which are also angled at the extremity of the third median nervule.

Expanse 30–52 millim.

Specimens from Yokohama in Pryer's collection. I took the species in Satsuma in May and at Fusan in June, and I have received it from Gensan, Ningpo, the island of Kiushiu, Ichang, Chang-yang, and Moupin: taken in June in the three last-named localities.

Distribution. Japan; Kiushiu; Corea; Central, Western, and North-eastern China.

Similar to *T. protusa*, Butl., but easily separated by the chequered fringes, which are preceded by a dark line. In the Japanese specimen the outer margin of primaries is straighter than in the Chinese examples.

ADDENDA ET CORRIGENDA.

Synegia purpurascens.

Parasynegia purpurascens, Warren, Novit. Zool. i. p. 410 (1894).
Synegia roseuria, Leech, Ann. & Mag. Nat. Hist. (6) xix. p. 204 (1897).

Stegania hyriaria.

Heterostegane hyriaria, Warren, Novit. Zool. i. p. 406 (1894).
Stegania irroraria, Leech, Ann. & Mag. Nat. Hist. (6) xix. p. 203 (1897).

Genus Pseudothalera.

(Warren, Novit. Zool. ii. p. 153 (1895).)

Pseudothalera stigmatica.

Pseudothalera stigmatica, Warren, Novit. Zool. ii. p. 154 (1895).

Warren describes this species from Western China, and records two male specimens.

Opisthograptis discriminaria.

Aspilatis discriminaria, Walk. Cat. Lep. Het. xxiv. p. 1073 (1862); Butl. Ill. Typ. Lep. Het. iii. pl. lii. fig. 9 (1879).

Also described by Walker from Shanghai. It appears to be a form of *Opisthograptis semilutata*, Led.

Tephrina irradiata.

Aspilatis irradiata, Walk. Cat. Lep. Het. xxiv. p. 1072 (1862); Butl. Ill. Typ. Lep. Het. iii. pl. lii. fig. 8 (1879).

Described by Walker from Shanghai. It is probably specifically identical with *Tephrina arenacearia*, Hübn.

Percnia albinigrata.

Percnia albinigrata, Warren, Novit. Zool. iii. p. 395 (1896).

Warren describes a female specimen from Niphon, Japan. I think it is not specifically distinct from *P. foraria*, Guen.

Genus Sebastosema.

(Warren, Novit. Zool. iii. p. 100 (1896).)

Sebastosema bubonaria.

Sebastosema bubonaria, Warren, Novit. Zool. iii. p. 100 (1896).

Warren describes one male specimen from Japan.

Tosaura (?) *pallida*, Warren, Novit. Zool. i. p. 380 (1894).

Warren describes this species from Japan, and places it in Orthostixinæ. I have not been able to see the type.

Anaitis perelegans.

Carsia perelegans, Warren, Novit. Zool. i. p. 398 (1894).

Closely allied to *A. plagiata*, Linn., and possibly only a Japanese form of that species.

Anaitis affinis.

Docirava affinis, Warren, Novit. Zool. i. p. 398 (1894).

I think this is not specifically distinct from *A. pudicata*, Guen.

Distribution. China and Japan (*Warren*).

Genus Atomophora.

(Alph. Rom. sur Lép. vi. p. 66 (1892).).

Atomophora falsaria.

Atomophora falsaria, Alph. Rom. sur Lép. vi. p. 66 (1892).

Alphéraky records one male specimen and three females from the province of Kan-sou, June and July.

Hab. Western China.

Rhodostrophia bisinuata.

Rhodostrophia bisinuata, Warren, Novit. Zool. ii. p. 98 (1895).

Warren describes one female specimen from Japan.

EXPLANATION OF THE PLATES.

[The descriptions of figs. 1, 6, 12, and 18 in Plate VIII. appear in the present volume (xx.); the remaining descriptions to Plates VII. and VIII. were published in vol. xix.]

Plate VII.

Fig. 1. *Cryptoloba rivularia*, sp. n., ♂, p. 550.
Fig. 2. *Eubolia similaria*, sp. n., ♂, p. 554.
Fig. 3. *Anaitis brunnearia*, sp. n., ♂, p. 553.
Fig. 4. *Scotosia bipunctularia*, sp. n., ♂, p. 555.
Fig. 5. *Eustroma fractifasciaria*, sp. n., ♀, p. 563.
Fig. 6. *Plemyria parvularia*, sp. n., ♂, p. 571.
Fig. 7. *Scotosia multilinearia*, sp. n., ♂, p. 555.
Fig. 8. *Naxa margaritaria*, sp. n., ♂, p. 545.
Fig. 9. *Scotosia latifasciaria*, Leech, ♂, p. 560.
Fig. 10. —— *interruptaria*, sp. n., ♂, p. 560.
Fig. 11. *Plemyria hastata*, var. *chinensis*, nov., ♂, p. 570.
Fig. 12. *Eustroma pulchraria*, sp. n., ♂, p. 566.
Fig. 13. *Lobogonia conspicuaria*, sp. n., ♂, p. 551.
Fig. 14. *Carige cruciplaga*, var. *extremaria*, nov., ♂, p. 552.
Fig. 15. *Lygranoa grisearia*, sp. n., ♀, p. 549.
Fig. 16. *Emmesomia parallelaria*, sp. n., ♀, p. 546.
Fig. 17. *Eustroma propriaria*, sp. n., ♂, p. 564.
Fig. 18. *Plemyria bellaria*, sp. n., ♂, p. 573.

Plate VIII.

Fig. 1. *Rhodostrophia* (?) *sinuosaria*, sp. n., ♂, p. 108.
Fig. 2. *Larentia fractifasciaria*, sp. n., ♂, p. 658.
Fig. 3. *Plemyria castaria*, sp. n., ♂, p. 572.

Fig. 4. *Cidaria albipunctaria*, sp. n., ♂, p. 645.
Fig. 5. *Larentia nitidaria*, sp. n., ♂, p. 657.
Fig. 6. *Hydrelia distinctaria*, sp. n., ♂, p. 80.
Fig. 7. *Larentia grataria*, Leech, ♂, p. 656.
Fig. 8. *Larentia* (?) *intersectaria*, sp. n., ♂, p. 667.
Fig. 9. *Photoscotosia fasciaria*, sp. n., ♂, p. 672.
Fig. 10. *Cidaria fervidaria*, sp. n., ♂, p. 646.
Fig. 11. *Larentia tripunctaria*, sp. n., ♂, p. 666.
Fig. 12. *Hydrelia electaria*, sp. n., ♂, p. 81.
Fig. 13. *Cidaria postalbaria*, sp. n., ♂, p. 645.
Fig. 14. *Larentia costinotaria*, sp. n., ♂, p. 670.
Fig. 15. *Cidaria ochracearia*, sp. n., ♂, p. 643.
Fig. 16. —— *fulgidaria*, sp. n., ♂, p. 641.
Fig. 17. —— *subochraria*, sp. n., ♂, p. 647.
Fig. 18. *Hydrelia angularia*, sp. n., ♂, p. 82.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

May 12, 1897.—Dr. Henry Hicks, F.R.S., President, in the Chair.

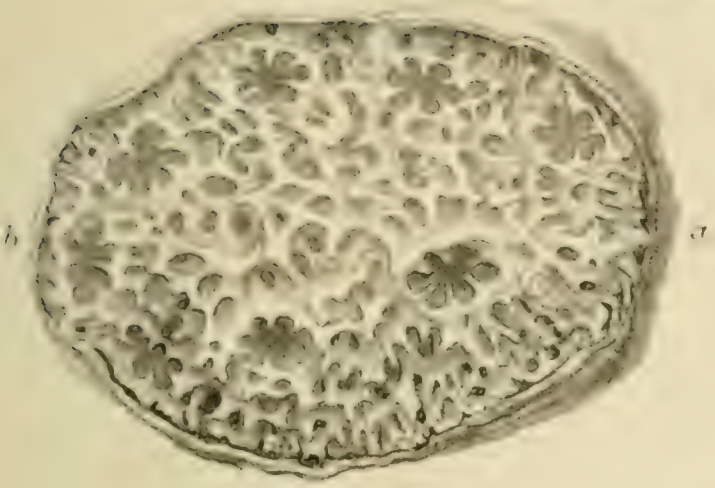
The following communication was read:—

'The Mollusca of the Chalk Rock: Part II.' By Henry Woods, Esq., M.A., F.G.S.

The first part of this paper, dealing with the Cephalopoda, Gasteropoda, and Scaphopoda, appeared in the last volume of the Quarterly Journal (vol. lii. p. 68). In the present communication the Author gives an account of the characters, synonymy, and distribution of the Lamellibranchia: 29 species are recognized, 6 being new; the genera represented are:—*Leda*, *Nucula*, *Arca*, *Limopsis*, *Modiola*, *Inoceramus*, *Ostrea*, *Chlamys*, *Lima*, *Spondylus*, *Plicatula*, *Cardium*, *Cardita*, *Arctica*, *Trapezium*, *Corbis?*, *Martesia?*, and *Cuspidaria*.

In the concluding part the Author compares the fauna of the *Reussianum*-zone (Chalk Rock) in England with that of other European areas, particularly N.W. Germany and Saxony. In the latter country the number of species in some groups—particularly Gasteropoda and Lamellibranchia—is much greater than in England; this difference is probably due to the sea having been of less depth than in the English area. It is noticed that the species of Cephalopoda have a much wider geographical distribution than the other groups of the Mollusca.

Finally, by a study of the present distribution of the genera—particularly of those which form the predominating element in the fauna,—taken in conjunction with the other characters of the zone, the Author arrives at the conclusion that in England the *Reussianum*-zone was probably formed between the depths of 100 and 500 fathoms.



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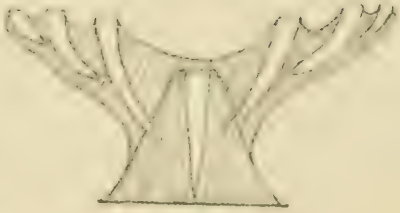

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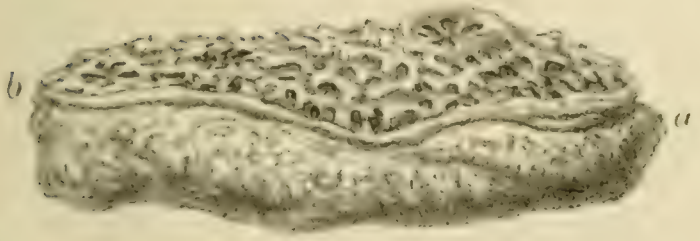

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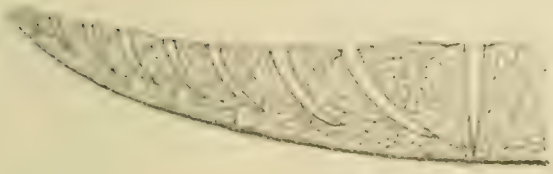

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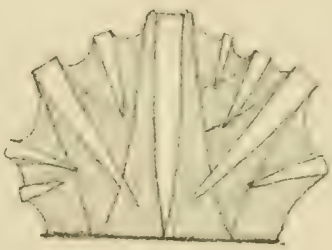

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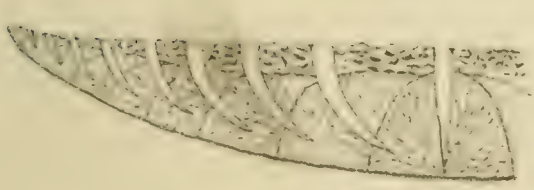

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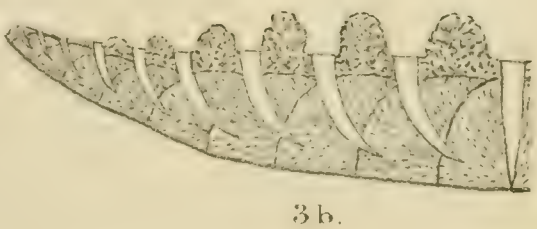

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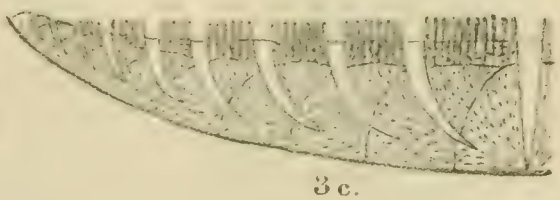

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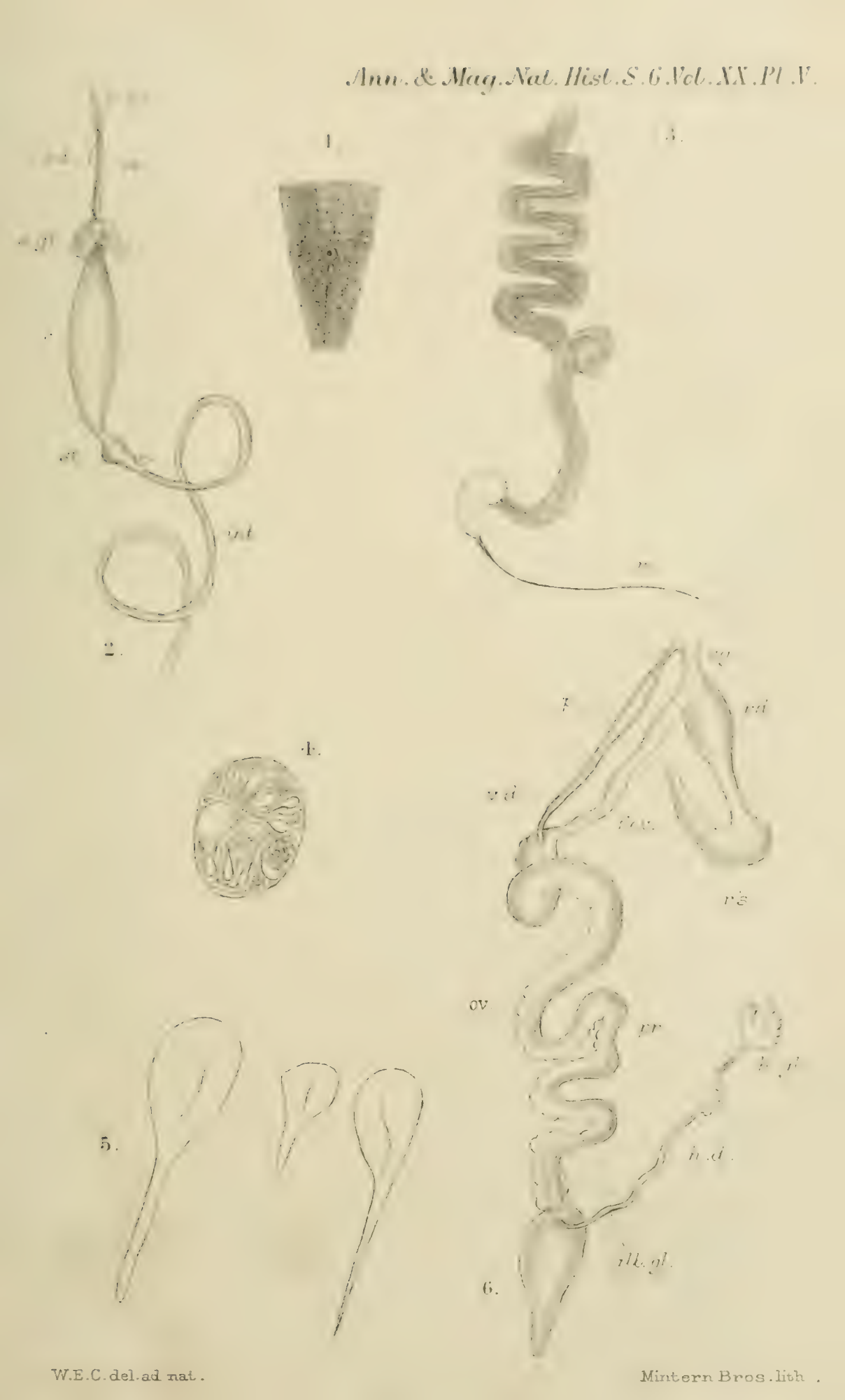
STRUCTURE OF MONTIPORINÆ.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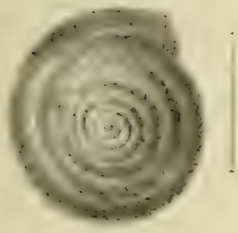

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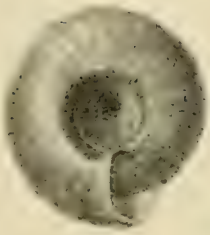

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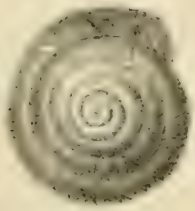

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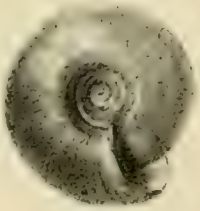

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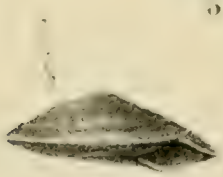

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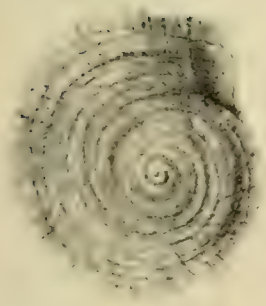

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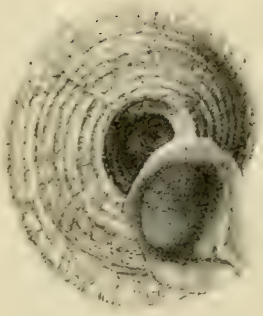

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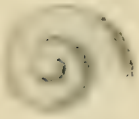

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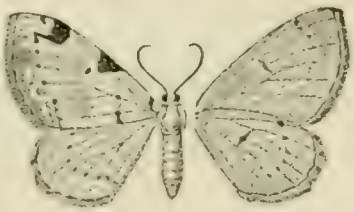

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W. Purkiss, del.

W. Purkiss, del.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 117. SEPTEMBER 1897.

XXV.—*On the Genera and Species of Tropical African Arachnida of the Order* Solifugæ, *with Notes upon the Taxonomy and Habits of the Group.* By R. I. Pocock, of the British Museum of Natural History.

The Ethiopian Region, or that part of Africa which lies to the south of the Sahara, is singularly poor in genera of Solifugæ. Two at most, namely *Hexisopus* and *Ceroma*, are peculiar. The others are common to the Mediterranean district of the Palæarctic, but of these only *Solpuga* can claim to be regarded as typically Ethiopian, since the rest are to be looked upon as emigrants southwards from the desert tracts of Egypt and Nubia to physically similar areas in the countries of the Somali and Masai. This dearth of genera, however, is largely counterbalanced by richness in the number of species of the genus *Solpuga*, which spreads from Somaliland and the Congo over the whole of South Africa, including Cape Colony. It is with some of the species of this genus that have recently come to hand that this paper largely deals. The notes concerning habits have been principally collected from the material on this subject kindly supplied by Mr. G. A. K. Marshall.

The African genera may be classified according to the following table. Most of the genera not represented in the Ethiopian Region will, I suspect, fall into the Solpuginæ of the family Solpugidæ, though, perhaps, a few subfamilies in addition to the two here recognized will have to be ultimately established.

a. Legs short, posterior three pairs very robust, with their distal segments strongly spined; fourth leg subequal to third in length, without claws, its coxa and trochanter (three basal segments) as long as the rest of the limb and furnished with only three malleoli* (according to Simon) ..... Fam. HEXISOPODIDÆ, nov.

b. Legs long or short, fourth pair at most weakly spined and considerably longer and stronger than the others, armed with two claws†, its coxa and trochanter much shorter than the rest of the appendage and bearing five malleoli on each side in the adult ‡.

a^1. Abdominal tracheal stigmata lying behind and under the posterior margin of the second and third sternal plates and protected by comb-like plates; basal segment of claws hairy; tarsus of palp freely movable..... Fam. GALEODIDÆ (*s. s.*).

b^1. Abdominal tracheal stigmata visible upon the posterior margin of the second and third sterna, lying in a triangular excision of the plates; claws free from hairs; tarsus of palp immovably fused to the protarsus ..... Fam. SOLPUGIDÆ (*s. s.*).

a^2. Anal segment small, subcircular, the anal aperture extending from its inferior almost up to its superior edge. Subfam. *Solpuginæ*, nov.

b^2. Anal segment of large size, transversely elliptical, the anal aperture not extending more than halfway from its lower border towards the dorsal border§ ..... Subfam. *Rhagodinæ*, nov.

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* I have applied the term *malleolus* to the racquet-shaped organs situated upon the basal segments of the fourth leg.

† The genus *Gnosippus*, Karsch, represented by one species from Egypt, and probably belonging to the Solpugidæ, is described as having no claws on the legs of the fourth pair. It is also said to be peculiar in that the coxa of this limb is nearly as long as the femur. But a glance at the figure of this appendage shows that Karsch has mistaken the coxa for the trochanter. As a matter of fact, the trochanter is scarcely longer than usual; but, if the figure is to be trusted, it presents the unique character of being undivided instead of bisegmented as in the rest of the order. The segment which Karsch refers to as the trochanter is the segmented basal end of the femur.

‡ ? *Zombis* of Simon, based upon a specimen from Jaffa, and said to be characterized by the possession of only three pairs of malleoli, three tarsal segments on the third and fourth legs, and only a pair of setæ on the ocular tubercle. But, as is explained below (p. 258), the number of malleoli, of tarsal segments, and of ocular setæ is often but an indication of immaturity, and that it is probably so in the case of *Zombis* may be inferred from the fact that the type, *pusiola*, is only 9 millim. long.

§ First pointed out by Hansen, Ent. Meddel. iv. p. 191.

Family **Hexisopodidæ**.

This family contains the single genus *Hexisopus*, represented by two species confined, so far as is at present known, to South Africa. The generic synonymy is as follows:—

Aellopus, C. Koch, Arch. Naturg. 1842, pt. i. p. 354; id. Uebersicht des Arach.-syst. pl. v. p. 97 (1850) (nom. præocc.).
Hexisopus, Karsch, Berl. ent. Zeitschr. xl. p. 109 (1879).

The two described species are:—

(1) *Hexisopus lanatus*, C. Koch, Arch. Naturg. 1842, pt. i. p. 354; id. Die Arachniden, xv. p. 102, fig. 1439 (sub *Aellopus*).
Loc. Cape of Good Hope.

(2) *Hexisopus fodiens*, Simon, Ann. Soc. Ent. France, 1887, p. 374, pl. vi. figs. 6 & 7.
Loc. Kalahari Desert.
The British Museum has no representative of this interesting Arachnid.

Family **Galeodidæ** (sensu stricto).

Genus GALEODES, Olivier.

Galeodes, Oliv. Encycl. Méthod. vi. p. 579 (1791).
Rhax, Hermann, Mém. Ins. Aptérol. pp. 13 & 15 (1804).

Type *araneoides*, Pallas.

Olivier established the genus *Galeodes* for the reception of two species, namely *Phalangium aranoides* of Pallas and the South-African species which he himself described as *setigera*. C. Koch (Arch. Nat. 1842, pt. i. p. 350 &c.) first dismembered the genus and applied the term *Galeodes* to the *araneoides* section, thus selecting the latter as its type.

Rhax of Hermann is stated by its founder to be synonymous with *Galeodes* of Olivier. Consequently C. Koch had not the power to apply the name to species not included by Olivier under *Galeodes*.

The genus *Galeodes* nearly resembles *Rhagodes* (*cf. infrà*) in distribution, being essentially a Palæarctic form, but extending into Somaliland, where it is represented by the Arabian and Egyptian species *G. arabs*, C. Koch.

Family Solpugidæ.

Subfamily *Rhagodinæ*, nov.

This group is established for the reception of the single genus hitherto known as *Rhax*, for which I propose the new name *Rhagodes*, the term *Rhax* having been up till now used by myself and others in a sense inadmissible according to the rules of nomenclature I adopt (*vide suprà* under *Galeodes*).

Like *Biton* and *Galeodes*, *Rhagodes* is also an alien from the Palæarctic Region, being found in abundance all over Persia, Afghanistan, parts of India, and Africa north of the Sahara. On the west of Africa it extends as far south as Gambia and on the east as far as Somaliland, Mombasa, and Masailand.

Subfamily *Solpuginæ*, nov.

The Ethiopian genera may be recognized by the following table:—

a. Tarsi of second and third legs composed of four segments, of fourth of seven segments.
  a[1]. Ocular tubercle with many bristles; rostrum not deflexed apically; protarsus of palp in ♂ scopulate beneath ..... *Solpuga*.
  b[1]. Ocular tubercle with a few symmetrically arranged bristles, the anterior two very long; rostrum apically deflexed; protarsus and tarsus of palp in ♂ not scopulate but armed below with many short strong spines ..... *Zeriassa*, nov.
b. Tarsi of second and third legs composed of not more than two segments, of fourth leg of not more than four segments.
  a[2]. Fourth tarsus four-jointed, second and third tarsi two-jointed..... *Biton*.
  b[2]. Fourth tarsus composed of but one or two segments.
    a[3]. Tarsi of posterior three pairs of legs two-jointed.. *Ceroma*.
    b[3]. Tarsi of posterior three pairs of legs one-jointed.. *Paracleobis*.

Genus Paracleobis, Poc.

Ann. & Mag. Nat. Hist. (6) xvi. p. 95 (1895).

Type *P. dorsalis*, Latreille.

This genus is equivalent to *Gluvia*, C. Koch, as restricted by Simon, who, in 1879, selected *striolata* as its type. Simon, however, believed that *striolata* was synonymous with *dorsalis* of Latreille; but according to Karsch (Arch. Nat. 1880, p. 237) this is an error. Consequently since *Gluvia* has been affixed definitely to *striolata*, the genus typified by

dorsalis was without a name until I applied *Paracleobis* to it in 1895.

Like most of the other genera of Solpuginæ, *Paracleobis* is not typically an African form, its species being found in the countries bordering the Mediterranean basin. A few species, however, have been described from Somaliland and Socotra.

Genus Biton, Karsch.

Arch. Naturg. 1880, p. 234.

The two genera, *Dæsia* (type *præcox*, C. Koch, from Mexico) and *Biton* (type *Ehrenbergi*, Karsch, from Arabia), established by Karsch, are, according to their diagnoses, indistinguishable, as Simon has pointed out (Ann. Mus. Genov. xviii. p. 253, 1883). If this be the case in reality, the name *Dæsia* has the priority; but until the type of *Dæsia* has been thoroughly re-examined it appears to me to be wiser, for geographical reasons, to look upon the two genera as distinct.

Though included in the above table of genera, the genus *Biton* does not, properly speaking, belong to the African—that is to say, the Ethiopian—fauna, being merely an alien from the Mediterranean district of the Palæarctic. The known species have been recorded from Tunis, Egypt, Arabia, Somaliland, &c.

Genus Ceroma, Karsch.

JB. Hamburg. Anst. ii. p. 137, figs. 8, 9 (1885).

Ceroma Johnstonii, sp. n. (Figg. 1–1 *a*.)

♂.—*Colour* a tolerably uniform fusco-testaceous or greyish-brown tint, not distinctly banded as in *C. ornatum*; mandibles, head-plate, and palpi, with the exception of the base of the femur, palely infuscate; femur, tibia, and distal end of protarsus of legs also more or less infuscate; the terga showing an indistinct fuscous patch on each side.

Head-plate moderately convex, dilated at the angles, with very faint divisional line, furnished with short iridescent hairs and longer fine setæ; tubercle large, bearing fine setæ, especially in front.

Mandible rather strongly convex above and armed with many long bristles, spiniform and slender; upper jaw with a slight sigmoid flexure, the upper edge concave at the base, convex distally, armed below with two large subequal teeth, affixed some distance behind the tip, and followed by an outer and an inner series of four teeth, the first of the inner series

being of considerable size; lower jaw slightly exceeding the upper, armed with three more or less fused teeth; a radiating tuft of spiniform setæ at the base of the flagellum; *flagellum* long, slender, but with its edges tightly folded over, lying close to the upper surface of the mandible, and extending back almost to its base; its basal portion much enlarged, somewhat as in *Solpuga*, but lying backwards, not forwards; stridulating-ridges very small.

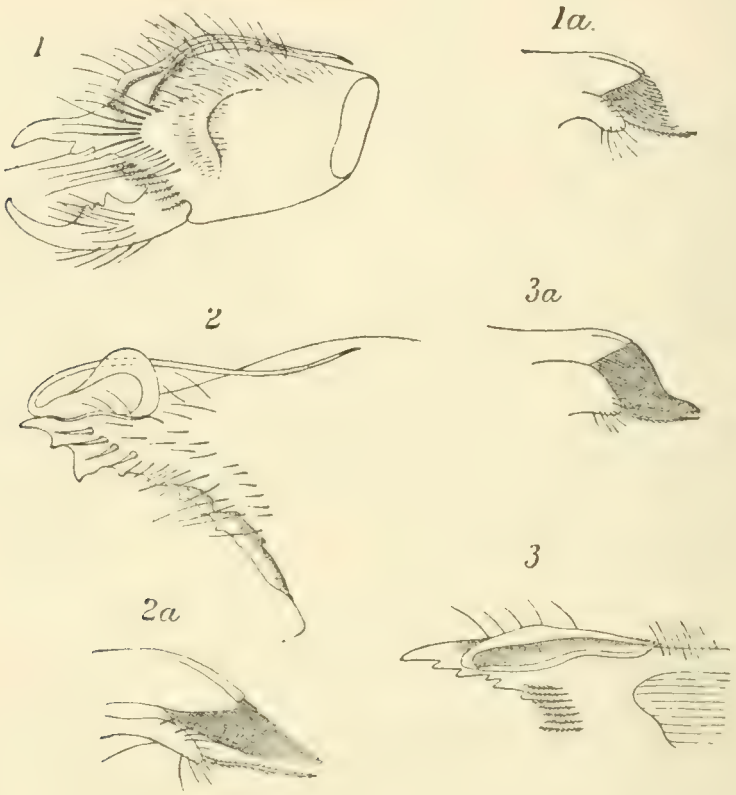

Fig. 1. Inner surface of mandible of *Ceroma Johnstonii*, sp. n.
Fig. 1 *a*. Side view of rostrum of *Ceroma Johnstonii*, sp. n.
Fig. 2. Flagellum and upper fang of mandible of *Zeriassa bicolor*, Poc.
Fig. 2 *a*. Side view of rostrum of *Zeriassa bicolor*, Poc.
Fig. 3. Flagellum and upper fang of mandible of *Blossia rufescens*, sp. n.
Fig. 3 *a*. Side view of rostrum of *Blossia rufescens*, sp. n.

Rostrum as in figure, the upper process surpassing the lower and longer than it, deflexed apically; the lower also somewhat strongly deflexed.

Palpi and *legs* mostly not spiny, covered with short hairs and long setæ; tarsus and protarsus of palp truncate and incrassate, the two almost indistinguishably fused; legs of first pair rather robust, armed with two very distinct claws; tibia of second and third pair with one distal superior spine, protarsus with three superior spines; distal tarsal segment

less than half the length of the proximal. *Arolium* beneath the tarsal claws very large.

Abdomen without accessory spinules on its lower surface.

Measurements in millimetres.—Total length 16; width of head-plate 3·5; length of mandible 3·5; length of palp 11, its tibia 3·5, tarsus and protarsus 4; of third leg 9; of fourth leg 17, its tibia 3·5, protarsus 3 *.

Loc. Nyika plateau (6000–7000 feet), in Nyasaland. A single example collected by Mr. Whyte, and dedicated to Sir H. H. Johnston.

This specimen seems to be referable to the genus *Ceroma* of Karsch, there being nothing in the diagnosis of the latter to prohibit such a belief, and much that is in its favour. It is possible also that it may prove to be the male of the typical and only known species, namely *ornatum* †, which was obtained in Masailand. But there is no evidence to support this, and some, apart from geographical reasons, to show its improbability. For example, in *ornatum* the abdomen is ornamented above with three longitudinal black bands: these are not observable in the type of *Johnstonii*, nor are the legs and head-plate marbled with black.

Genus Zeriassa, nov. (Figg. 2–2 *a*.)

Differing from *Solpuga* in that the ocular tubercle is provided with a pair of long setæ in front and a few symmetrically disposed shorter setæ behind, and the extremity of the rostrum is bent downwards instead of being horizontal. The protarsus and tarsus of the palp of the male are armed with short stout spines beneath and not scopulate.

Type *Z. bicolor*, Poc.‡

So far only one species of this genus has been discovered.

Genus Solpuga, Licht.

Solpuga, Lichtenstein, Cat. rerum nat. iii. p. 216 (1796); Licht. & Herbst, Nat. ungeflügelt. Insekten, i. p. 22 (1797); C. Koch, Arch. Naturg. 1842, pt. i. p. 351, and of recent authors.
Gætulia, Simon, Ann. Soc. Ent. France, 1879, p. 107 (nom. præocc.).
Cærellia, id. Bull. Soc. Ent. France, 1879, p. clx.
Zeria, Simon, Ann. Soc. Ent. France, 1879, p. 118.

Type *S. chelicornis*, Licht.

This genus was primarily equivalent to *Galeodes* of Olivier,

* The measurements of the limbs in this and all cases in this paper are taken along the outer side of the limb, and include the trochanter but not the coxa. The total length includes the mandible.

† JB. Hamburg. Anst. ii. 1885, p. 137, figs. 8, 9.

‡ *Zeria bicolor*, Pocock, from Somaliland, is described in Dr. Donaldson Smith's 'Through unknown African Countries,' p. 392 (London: Arnold, 1897).

since the species it contained were *araneoides* of Pallas, *fatalis*, Licht., congeneric with it, and *chelicornis* congeneric with *setigera*. C. Koch was the first to assign to the genus the significance it now bears, his action being tantamount to selecting *chelicornis* as the type.

I have added the genus *Zeria* to the list of synonyms of *Solpuga* under the belief that it was based upon a young specimen of *Solpuga*. The type *persephone* from Algeria measures only 9 millim. long, and is said to differ from *Solpuga* in having a pair of ocular setæ instead of a cluster of them and no spines on the fourth protarsus. But in an example in the British Museum from the same country and closely resembling the description of the type there are spines on the fourth protarsus. Moreover, in an immature specimen of what I believe to be *Solpuga*, sent with many other examples of the genus from the Umfuli River in Mashunaland by Mr. G. A. K. Marshall, the ocular tubercle has but two setæ, a further resemblance between this specimen and the Algerian being noticeable in the presence of a distinct long *third* claw on the second, third, and fourth legs and the presence of only *three* malleoli on each side. Both these characters are, I am persuaded, signs of immaturity. Lastly, it may be added that the example from the Umfuli (measuring 7 millim. in length) has the tarsus of the fourth leg with only five, instead of seven, differentiated segments, while those of the second and third have only two, or at most three, instead of four segments. In the British Museum example of *persephone* the tarsal segments are as in *Solpuga*.

The following species of the genus are represented in the British Museum.

Solpuga dentatidens (Simon).

Gætulia dentatidens (Simon), Ann. Soc. Ent. France, 1879, p. 115.

Described from the White Nile. The Museum possesses two male examples from inland of Berbera in Somaliland (*E. Lort Phillips*).

Solpuga brunnipes (L. Dufour).

Galeodes brunnipes, Dufour, Hist. Nat. *Galeodes*, p. 52, pl. ii. fig. 6 (1861); Simon, *op. cit.* p. 113.

Of this species, which seems to range from Algeria to Abyssinia, the Museum possesses a single female example obtained on the north-eastern shore of Lake Stephanie by Dr. Donaldson Smith.

Solpuga Keyserlingii, Poc.

Solpuga Keyserlingii, Poc. Ann. & Mag. Nat. Hist. (6) xvi. p. 86.

Based upon a specimen from an unknown locality, but probably an inhabitant of Somaliland or Masailand, seeing the nearness of its relationship to *S. Parkinsoni* (see p. 263).

Solpuga nigrescens, Poc.

Solpuga nigrescens, Poc. Ann. & Mag. Nat. Hist. (6) xvi. p. 88 (1895).

Loc. Lower Zambesi (*J. Grant*: type).

The Museum also possesses specimens of apparently the same form from the north-eastern region of Victoria Nyanza (*Dr. Ansorge*).

Solpuga paludicola, Poc.

Solpuga paludicola, Poc. Ann. & Mag. Nat. Hist. (6) xvi. p. 84, pl. iv. fig. 4 (1895).

Loc. Nyasaland.

The British Museum has several specimens of this species obtained on the shores of Lake Nyasa by the members of the Universities Mission and from Zomba by Sir Harry Johnston.

Solpuga Monteiri, Poc. (Fig. 6.)

Solpuga Monteiri, Poc. Ann. & Mag. Nat. Hist. (6) xvi. p. 87 (not pl. iv. fig. 6) (1895).

Loc. Delagoa Bay (*Mrs. Monteiro*).

Owing to an unaccountable error, fig. 6 on pl. iv. of the above paper, though assigned to this species, does not represent the mandible of the male. I take the opportunity of publishing an accurate figure of the organ in question (see fig. 6).

Solpuga Marshalli, Poc.

Solpuga Marshallii, Poc. Ann. & Mag. Nat. Hist. (6) xvi. p. 91.

Loc. Salisbury, Mashonaland, 5000 ft. alt. (*G. A. K. Marshall*).

Solpuga hostilis, White.

Solpuga hostilis, White, Appendix to Methuen's 'Life in the Wilderness,' p. 317, pl. ii. fig. 5 (1846); Pocock, Ann. & Mag. Nat. Hist. (6) xvi. p. 89, pl. iv. fig. 7 (1895).

The only locality ascribed to this species by White was "S. Africa, near the tropic of Capricorn." Mr. Guy Marshall has, however, recently sent me a series of nicely preserved specimens from Estcourt in Natal (4000 feet).

The head and mandibles are a uniform reddish yellow, the two eyes alone being black; the legs also are yellowish red, though slightly infuscate distally, the posterior pair being strongly tinted with a blood-red colour; the posterior terga are uniformly black all over, but the anterior are paler in the middle; and on each side of the sterna there is a blackish spot.

In both sexes the palpus is longer than the third leg and its tibia is longer than the protarsus of the fourth, which is distinctly shorter than the tibia of the same limb.

A young specimen of this species, measuring 10 millim. in total length, has only three malleoli on each side—two on the coxa and one on the basal segment of the trochanter of the fourth leg—as described in the so-called genus *Zombis*, Simon. But in an example 15 millim. in length the two additional malleoli have appeared.

Solpuga ferox, Poc.

Solpuga ferox, Poc. Ann. & Mag. Nat. Hist. (6) xvi. p. 83, pl. iv. fig. 3 (1895).

Loc. Port Elizabeth (*I. L. Drège*).

Solpuga Derbiana, Poc.

Solpuga Derbiana, Poc. *loc. cit.* p. 90, pl. iv. fig. 8.

Loc. "Interior of S. Africa" (*Earl of Derby*).

The Museum has only a single male example of this species.

Solpuga lethalis, C. Koch.

Solpuga lethalis, C. Koch, Arch. Naturg. 1842, pt. i. p. 352; id. Die Arachniden, xv. p. 70, fig. 1465.

The British Museum has several specimens referred to this species ticketed "S. Africa" (*Dr. Smith*).

Solpuga Butleri, Poc.

Solpuga Butleri, Poc. *loc. cit.* p. 88.

Loc. Congo.

Solpuga venator, sp. n. (Fig. 7.)

Colour of head, jaws, palpi, and legs a uniform yellow, without any black pigment; abdomen furnished with long silky greenish-yellow hairs.

Head furnished on each side in front with spiniform setæ, its width about $\frac{3}{5}$ the length of the tibia of the palp and a little more than $\frac{2}{3}$ the length of the tibia of the fourth leg.

Mandible armed above, throughout its length, with setiform spines protecting the flagellum. Basal lamina of flagellum moderately high, rounded, the terminal portion curving backwards on a level with the first tooth of the upper fang, lying close to the basal lamina and extending almost back to the ocular tubercle, its apex simple, undivided, its distal third strongly sinuate. Only one small tooth between the second and third largest teeth on the upper fang.

Palp with its tibia a little longer than the tarsus and protarsus (15·5 : 15) and excelling the length of the tibia of the fourth leg (15·5 : 14), which also exceeds the length of the fourth protarsus (14 : 13); third leg shorter than the palp, its protarsus equal to the width of the head; fourth leg longer than the palp by half its protarsus and the tarsus.

Measurements in millimetres.—Total length 53; length of mandible 12·8; width of head 9; length of palpus 48, of first leg 40, of second 35, of third 43, of fourth 66.

Loc. Kleinpoort, in the Eastern Karroo; taken in a house (*Miss Anna Howarth*: type). Also damaged specimens of apparently the same species from South Africa (*Dr. Quain*) and Port Elizabeth (*J. M. Leslie*).

This species seems to differ from *S. lethalis*, Koch, in having no tooth near the apex of the flagellum, such as is found in the male of *lethalis* according to Karsch and according to a specimen identified as *lethalis* in the collection of the British Museum.

Solpuga Darlingii, sp. n. (Fig. 5.)

♀.—*Colour.* Prevailing tint an ochre-yellow, the headplate infuscate; femora and tibiæ of the posterior legs, especially the fourth pair, as well as the tibia and distal end of the femur of the palpus, also infuscate; legs of first pair pale; tergal plates of abdomen not noticeably darker than the lateral portions.

Cephalic plate about equalling in width the length of the protarsus of the palp, distinctly less than that of the tibia, also a little less than the length of the tibia or of the protarsus of the fourth leg; width of ocular tubercle less than length of tarsus of palp; the setæ on the tubercle spiniform.

Mandibles armed as in *S. ferox*, Poc. (Ann. & Mag. Nat. Hist. (6) xvi. p. 83), from Port Elizabeth; legs also clothed and armed as in *ferox*; *malleoli* small, with the inner angle nearly rectangular. Genital operculum with its posterior border transverse, the inner angles of each half not produced, but rectangular.

♂.—Resembling female in colour, but with smaller head, much longer legs, &c.; the head-plate only a little more than half the length of the tibia of the palp and one third less than the length of the tibia or protarsus of the fourth leg. Protarsus of palp scopulate beneath; palp longer than third leg, its tibia considerably longer than the tibia or protarsus of fourth leg.

Mandible with dentition much resembling that of the female, though the teeth are smaller and the upper fang less strongly curved distally; the flagellum with its basal part rising into a high crest with upright posterior border, rounded extremity, and convex anterior border; the distal portion short, curving upwards and backwards at a point on a level with the second tooth of the upper fang, and passing a little beyond the posterior border of the upstanding basal lamella, becoming gradually attenuated at the tip.

Measurements in millimetres — ♀. Total length (including mandibles) 56, length of mandible 15; width of head 11; length of palp 39, of first leg 32, of second leg 30, of third leg 38, of fourth leg 58; tibia of palp 12, protarsus and tarsus 13; tibia and protarsus of fourth leg 11·5.

♂. Total length 54, length of mandible 11; width of head 9·5; length of palp 50, of first leg 39, of second leg 36, of third leg 46, of fourth leg 67; tibia of palp 17, protarsus and tarsus 15·5; tibia and protarsus of fourth leg 13·5.

Loc. Gadzima, on the Umfuli River (4200 feet alt.), in Mashonaland. An adult male and female sent by Mr. G. A. K. Marshall.

I have great pleasure in dedicating this species to Mr. James ffolliott Darling, whose labours as a collector have added considerably to our knowledge of the natural history of Mashonaland.

Solpuga sericea, sp. n. (Fig. 4.)

Colour, when dry, of a greyish tint, owing to the clothing of white, yellow, or greyish-white hairs on the limbs and body, the limbs, especially the posterior pair, being furnished in addition with long silky white setæ; in alcohol the head and mandibles are of an ochre-yellow, the mandible adorned with three black stripes, whilst on the head the tubercle is black and there is a black patch on each side, from whence a black curved line passes back to the middle point on the posterior margin of the head, this point being joined to the tubercle by a fainter median longitudinal line; the terga of the abdomen are black, but its sides are broadly white;

limbs mostly black above, but the femora and basal joints largely yellow, the femur of the palp having merely a median longitudinal dorsal stripe; lower surface of abdomen and of basal segments of legs pale.

Head flattish, furnished in front with a few symmetrically arranged stout spiniform bristles; bristles on the tubercle

Fig. 4. Flagellum and upper fang of mandible of *Solpuga sericea*, sp. n.
Fig. 5. Ditto of *S. Darlingii*, sp. n.
Fig. 6. Ditto of *S. Monteiri*, Poc.
Fig. 7. Ditto of *S. venator*, sp. n.
Fig. 8. Ditto of *S. Keyserlingii*, Poc.
Fig. 9. Ditto of *S. Parkinsoni*, sp. n.

also spiniform and symmetrically placed; head-plate more than half but less than two thirds the length of the tibia of the palp.

Mandible with relatively a small number of spiniform setæ above; the upper fang long, carinate above, curved downwards at the apex; teeth of the upper jaw strong, sharp, and normal; two small teeth intervening between the second large tooth and the next largest; flagellum with moderately elevated basal lamina, the terminal portion smooth, taking its backward curve at a point just behind the line of attachment of the second tooth of the fang, running backwards and

upwards at an angle of 45°, straight throughout the greater part of its length, but with the slender apex curved downwards.

Palp with its tibia a little longer than the tarsus and protarsus, the latter only lightly curved, scopulate beneath; tibia of palp just about equal to that of fourth leg, shorter than protarsus of latter; palp shorter than third leg and not two thirds the length of the fourth leg.

Legs long and slender.

Measurements in millimetres of type (♂).—Total length 30, length of mandible 7, of palp 24·5, of first leg 22, of second leg 20, of third leg 26, of fourth leg 43, of tibia of palp 8, of its protarsus and tarsus 7·5, of tibia of fourth leg 8, of its protarsus 8·8.

Loc. Gadzima on the Umfuli (4200 feet), in Mashonaland (*G. A. K. Marshall*).

Solpuga caffra, sp. n.

Colour. Cephalic plate, mandibles, and limbs a uniform deep olive-green, paler towards the extremities of the legs; tergal plates of the abdomen coal-black, the rest of this region, as well as the cephalothorax, olive-green; the pubescence covering the integument silky white and red; edges of malleoli infuscate.

Width of cephalic plate much exceeding the length of the tibia or of the protarsus and tarsus of palp and equal to the tibia and nearly half the protarsus of the fourth leg; ocular tubercle clothed with slender, not spiniform, setæ. Tibia of fourth leg exceeding protarsus by about half the length of the first segment of the tarsus.

Measurements in millimetres.—Total length 52, length of mandible 16; width of head-plate 12·3; length of palp 30, of fourth leg 47, of tibia of palp 9·3, of its tarsus and protarsus 10; tibia of fourth leg 9·2, protarsus 7·8.

Loc. Estcourt, in Natal (4000 feet alt.).

Two adult females obtained by Mr. G. A. K. Marshall, who informs me that he saw but failed to capture a third specimen at the junction of the Blue Krantz and Tugela Rivers.

In the uniformly dark infuscate tint of its head, jaws, limbs, and abdomen this species resembles the two species *Butleri* and *nigrescens*, which were described in Ann. & Mag. Nat. Hist. (6) xvi. p. 88 (1895).

Solpuga Parkinsoni, sp. n. (Fig. 9.)

Colour. Carapace, limbs, mandibles, &c. a uniform ochre-yellow, only the ocular tubercle black.

Closely related to *S. Keyserlingii*, Poc. (*loc. cit.* p. 86), from which it differs hardly in anything apart from the form of the flagellum. In *Keyserlingii* the flagellum is abruptly curved backwards from the base, then passes as a nearly straight rod upwards and backwards, becoming slenderer at the tip, which is delicate, sinuate, and curved downwards; in the middle of its length it is finely serrate below, the serration showing as a row of fine teeth on the outer edge of the upper surface * (fig. 8). In *S. Parkinsoni*, on the contrary, the flagellum is less abruptly curved backwards, rising nearly vertically from the basal portion and passing backwards with a bold curve, the apex being downcurved and lamellar, while the serration takes the form of a denticulate crest passing from the anterior convex side of the flagellum to its inner edge, the flagellum being somewhat strongly geniculate in the posterior fifth of its length.

Measurements in millimetres.—Total length 43, length of mandible 10·3; width of head 8, of ocular tubercle 2·5; length of palp 43, of fourth leg 60, of tibia of palp 14, of its tarsus and protarsus 13·5, of fourth leg 12·5.

Loc. "Gol Addeh (3000 feet alt.), 11¾ miles to the S.W. of Arregir, which lies at the foot of the Burdab range of hills, lat. 9° 10′ 16″ N., long. 46° 10′ 35″ E., in Somaliland."

Mr. Parkinson has kindly furnished the following notes respecting the habits of this *Solpuga* and of a specimen of *Galeodes arabs* which he obtained at Arregir:—"About 8 P.M., as I was adjusting the theodolite to take the observations which determined the above position [*i. e.* of Arregir], I heard a slight noise as of a mouse scuttling about, and upon turning the lantern in the direction of the sound saw the spider [*G. arabs*], which, upon my attempting to approach, darted some three yards away with a velocity difficult to follow with the eye. After repeating this manœuvre several times, it stopped in a hollow between three stones, and was secured. I have only seen these animals on stony ground at the base of these hills, and they may be heard at night as I have

* N.B.—In the figure of the mandible and flagellum of this species published on pl. iv. fig. 5 of Ann. & Mag. Nat. Hist. (6) xvi. (1895), the flagellum lies too close to the upperside of the mandible and the teeth of the fang are too large, the terminal fang being not sufficiently prolonged. Moreover, in the description no mention is made of the serration of the flagellum.

described. In such places many remains of beetles may be seen in the morning; and although I have not actually observed the spiders devouring the insects, I suspect that they feed largely upon them, for the sound of the spider's dash is generally followed by a crumpling noise, such as would be produced by the crushing of a beetle between the spider's jaws. Their speed and energy is tremendous; but the natives do not consider them noxious, and, Somali-like, tell me there is no name for things so unimportant."

The following tables will show some of the differential features of the species known to me: —

Males*.

a. Upper mandibular fang furnished on the inner side or above at the base of the flagellum with a tooth against which the lower fang closes.
  *a*¹. Flagellum long, slender, simple, extending past the ocular tubercle; protarsus of palp fuscous.. *dentatidens*, Sim.
  *b*¹. Flagellum short, stout, toothed internally near the slender apex, which scarcely surpasses the basal lamina; palp wholly ochraceous..... *ferox*, Poc.
b. Upper mandibular fang without supernumerary tooth.
  *a*². Upper mandibular fang with a long untoothed interval between the tip and the basal tooth-armature (flagellum reaching to the eye).
    *a*³. Flagellum taking its backward curvature some distance behind the tip of the upper fang .. *Derbiana*, Poc.
    *b*³. Flagellum taking its backward curvature close to the tip of the fang.
      *a*⁴. Upper fang stout, nearly parallel-sided, distinctly toothed apically; the flagellum lying close to its upper edge ..... *Marshalli*, Poc.
      *b*⁴. Upper fang slender, concave above, scarcely toothed apically; flagellum rising high above its upper edge ..... *hostilis*, White.
  *b*². Upper fang continuously toothed from base to apex, strong.
    *a*⁵. Flagellum short, stout, apically truncate, scarcely surpassing lamina ..... *paludicola*, Poc.
    *b*⁵. Flagellum long or short, but slender and apically pointed.
      *a*⁶. Flagellum distinctly serrated, of medium length.
        *a*⁷. Flagellum curving abruptly backwards close to the basal lamina, sinuous only at tip ..... *Keyserlingii*, Poc.

* The males may be always distinguished from the females by the presence on the upperside of the mandible of that curious horny organ of unknown function called the *flagellum*. They also have longer legs, smaller mandibles, &c.

b^7. Flagellum rising more vertically with an open curvature, sinuous in the distal fourth of its length ..... *Parkinsoni*, sp. n.

b^6. Flagellum not serrated, long or short.

a^8. Flagellum short, only just surpassing the basal lamina.

a^9. Of large size: prevailing colour ochre-yellow, though partially infuscate; palpus much longer than third leg .. *Darlingii*, sp. n.

b^9. Of small size: head, mandibles, and limbs striped with black; palpus not longer than third leg ..... *sericea*, sp. n.

b^8. Flagellum long, reaching back to the ocular tubercle.

a^{10}. Apex of flagellum not distinctly sinuate, its basal portion lying high above the lamina..... *Monteiri*, Poc.

b^{10}. Apex of flagellum strongly sinuate, its basal portion lying close to the lamina.

a^{11}. Apex of flagellum simple ..... *venator*, sp. n.

b^{11}. Apex of flagellum bifid ..... *lethalis*, Koch.

Females.

a. Head, mandibles, and limbs black or deep olive-green above and below.

a^1. Width of cephalic plate less than the length of the tibia of the palp or of the fourth leg, equal to their protarsi ..... *Butleri*, Poc.

b^1. Width of cephalic plate greater than tibiæ or protarsi of palp and of fourth leg.

a^2. Colour almost black, edges of malleoli pale; width of cephalic plate only slightly exceeding length of tarsus and protarsus of palp and about equal to the tibia and one fourth of the protarsus of the fourth leg; tibia of fourth leg equal to protarsus in length ..... *nigrescens*, Poc.

b^2. Colour olive-green; edges of malleoli infuscate; width of cephalic plate exceeding length of protarsus and tarsus of palp by at least the length of the tarsus, and equalling the length of the tibia and almost one half the protarsus of the fourth leg; tibia of fourth leg exceeding protarsus by half the first segment of the tarsus..... *caffra*, sp. n.

b. Head-plate, mandible, and limbs mostly pale, though sometimes partially infuscate.

a^3. Inner angle of each half of the genital operculum produced.

a^4. Angles of operculum with strong lobate prominence; colour redder, distal segments of posterior legs red..... *hostilis*, White.

b^4. Angles of operculum not strongly produced; distal segments of posterior leg fuscous .... *Marshalli*, Poc.

b^3. Inner angles of operculum not produced, rounded.

a^5. Legs longer; width of head-plate less than

length of tarsus and protarsus or tibia of palp, and about equal to length of protarsus of fourth leg.

a^6. Head, palpi, and limbs mostly of a uniform yellow tint ..... *paludicola*, Poc.

b^6. Head partly infuscate; palpi and limbs with femora and tibiæ infuscate ..... *Darlingii*, sp. n.

b^5. Legs shorter; width of head-plate about equal to that of tarsus, and protarsus of palp greater than protarsus of fourth leg.

a^7. With two teeth on upper mandibular fang, between second and third largest teeth; width of head barely exceeding length of tibia of palp ..... *Monteiri* and *ferox*, Poc.

b^7. With only one tooth on upper mandibular fang between the second and third largest tooth.

a^8. Abdomen with a broad black dorsal band. *brunnipes*, L. Duf.

b^8. Abdomen without a broad black dorsal band..... *lethalis*, Koch.

The following South-African species of this genus that have been established are unknown to me, and I am unable to locate them by the figures and descriptions :—

S. chelicornis, Lichtenstein, Cat. rerum nat. iii. p. 218 (1796) ; Licht. & Herbst (Nat. ungeflügelt. Insekten, i. p. 40, pl. ii. fig. 1), from South Africa (*cf. infrà*, under *jubata*).

S. setigera, Oliv. (Encycl. Méthod. vi. p. 580, 1791), from the Cape of Good Hope.

S. rufescens, C. Koch (Arch. Naturg. 1842, pt. i. p. 382, and Die Arachniden, xv. p. 72), from the Cape of Good Hope, is based upon a female showing some resemblance to that of *S. hostilis*, White.

S. jubata, C. Koch (ibid. p. 73), is, according to Karsch (*op. cit.*), identical with *chelicornis*, Licht., the type of the genus. Whether this be the case or not, the two will apparently fall under a^3 of the above table (males), though they differ from *Derbiana* apparently in the much greater elevation of the flagellum.—*Loc.* Cape of Good Hope.

S. vincta, C. Koch (ibid. p. 74), will probably fall under a^3, but it has the flagellum short and angulate above. Both this species and the preceding are brown in colour, with a median black abdominal band and a silvery-white stripe on each side of it.—*Loc.* Cape of Good Hope.

S. badia, C. Koch (ibid. p. 75), based on a female from the Cape of Good Hope.

S. fusca and *hirtuosa*, C. Koch (*loc. cit.* pp. 76 and 78), from the Cape, are two small black-legged species about half an inch in length. The former probably will fall under a^3 and the latter perhaps under b^3.

S. lineata, C. Koch (ibid. p. 80), is perhaps related to *sericea*; it is a small yellow species, with the mandibles, trunk, and posterior three pairs of legs striped with black, the palpi and first legs being a uniform yellow.—From the Cape of Good Hope.

S. lateralis, Koch (*loc. cit.* p. 82), also from the Cape, will fall under a^1, but certainly differs from *dentatidens* in being only just over half an inch long and in having all the limbs fuscous.

S. producta, Karsch (Arch. Naturg. 1880, p. 236) (=*vincta*, Simon, Ann. Soc. Ent. France, 1879, p. 110, not *vincta* of Koch), from Lessouto to the north of the Cape, appears to be most nearly related to *S. hostilis*, White, but the flagellum does not reach to the base of the mandible.

S. merope, Simon (Ann. Soc. Ent. France, 1879, p. 112), from Zanzibar, is based upon a female.

S. niassa, Karsch (*loc. cit.* p. 237), from N'yassi (?Nyassa), has the flagellum short, as in *ferox*, but strongly toothed at the base, and there appears to be no supernumerary tooth on the upper fang.

S. nasuta, Karsch (*loc. cit.* p. 238), from Zanzibar, has the flagellum of medium length, but not reaching the ocular tubercle; its tip is both expanded and bifid.

S. Schweinfurthi, Karsch (*loc. cit.* p. 239), from Djur, has the flagellum of much the same length and shape as in *Keyserlingii*; it is not said, however, to be serrate.

S. scopulata, Karsch (*loc. cit.* p. 239), is based upon a female from Hantam. Differs from all the species known to me in having the front tooth of the lower jaw double.

Notes on Habits.

Mr. G. A. K. Marshall, who within the last few years has discovered in South Africa no fewer than four new species of *Solpuga*—namely, *S. Marshalli* from Salisbury, *S. Darlingii* and *sericea* from Gadzima, on the Umfuli, and *S. caffra* from Estcourt, Natal—has from time to time sent to me various

notes upon the habits of the species of *Solpuga* he has observed. Many of these I take the liberty of quoting verbatim. Mentioning in a letter that his attention had been attracted to a specimen of a Natal species [probably *S. hostilis*] by the sound it produced when burrowing, he replied as follows to a question of mine touching the stridulation of these animals:—"Until the arrival of your letter I had never thought of attributing the sound to stridulation, but merely to the trituration of the creature's powerful jaws against the hard ground in which they seem to prefer to dig their holes, the operation being performed with the jaws, and the sound ceasing when the spider stops digging. . . . . When walking into Hartley the other day I captured an example of a small species [probably *S. sericea*] which was running on the path in the hot sunshine, apparently searching for insects. The same evening I secured a specimen of yet another species [probably *S. Darlingii*], which came into my hut attracted by the light. I kept them alive for a day or two, but failed to detect any stridulating sounds whatever, though they both made a considerable noise by energetically biting at the sides of the boxes, one of them in a cardboard box nearly succeeding in gnawing its way through at one spot. The evidence, so far as it goes, only tends to increase my belief that the sounds made by the Natal species were caused by trituration, not stridulation. . . . But, unfortunately, owing to their lightning-like activity it is impossible to keep these creatures in an open vessel, and as the above specimens were both new to me, I was afraid to experiment with them while free, for fear of losing them." In a subsequent letter he adds:—"I was interested to learn from you that the noise made by Solpuga is really stridulation. I noticed the grooving on the mandible in a very large nocturnal species which I came across on the Umfuli River [*S. Darlingii*], but it never stridulated at all while I was examining it before putting it into the cyanide bottle. By the way, it is curious how much more rapidly these creatures succumb to the effects of this poison than either spiders or scorpions"*. And, lastly, writing in January

* On the tenacity of life of scorpions Mrs. Monteiro ('Delagoa Bay: its Natives and Natural History,' p. 192) makes the following remark:—"A large black scorpion was eight hours in my strongest poison-bottle before it succumbed to the deadly fumes. When I touched him with a stick after seven hours he elevated his wicked tail and opened his claws wide in a most savage manner." The greater susceptibility of the *Solpuga* to the fumes as compared with the scorpion is doubtless connected with the much richer development of its respiratory system, which consists of an elaborate system of tracheal tubes, branching throughout the body, that of the scorpion being composed of four pairs of small sacs.

of this year from Natal, he says:—"With regard to the stridulation of *Solpuga*, I must admit that I am almost becoming sceptical about it, at least in the species with which I am acquainted, for, though I have examined them carefully, on no occasion have I been able to detect any signs of stridulation, even when they have been persistently annoyed. And, moreover, I find it is impossible to produce it artificially by rubbing the chelæ together. Is it not possible that the striæ [fine upstanding ridges] might be useful in compressing food for the extraction of the juices?"

Touching the function of the palpi, and commenting upon Hutton's observation showing that they are used as suckers in climbing slippery places, he remarks:—"As far as I can see they seem to be used merely as tactile or, perhaps, auditory organs. They are usually carried well forward just off the ground, and appear to be highly sensitive." But in a subsequent letter he adds:—"I have been further investigating the use of the terminal organ on the palpus, and am fully satisfied that Hutton was right in supposing it to be a sucker. I first noticed this when teasing a specimen with a straw and trying to make it stridulate. The creature struck sharply at the straw with its palpi, pulling it slightly towards itself. Wondering how it was able to grasp the object, I tried again, and distinctly saw a gelatinous fan-shaped sucker protruding from the palpal knob and sticking firmly to the straw. . . . . I feel tolerably sure that the chief use of the sucker, which is evidently a very delicate organ, is for the purpose of grasping prey and conveying it to the mandibles. Owing to the extreme rapidity of their movements, it is almost impossible to observe exactly how they catch insects, but my general impression has always been that the prey is first caught by the palpi, and not by the mandibles direct." Specimens kept in captivity "devoured all sorts of small insects most voraciously, and, while eating, in addition to moving their nipper-like mandibles vertically, they also moved them alternately backwards and forwards in a horizontal direction."

With regard to general habits it is interesting to note that species of the same genus, *Solpuga*, are either diurnal or nocturnal. For example, Mr. Marshall was informed by a man "that when he was recently encamped at Hartley Hills he was forced to move his tent on account of its being overrun by a number of enormous spiders, evidently, from his description, a large Solpuga [probably *S. Darlingii*], which came in at night one at a time, attracted apparently by the light, and simply flew about it at lightning speed." On the other hand, Mr. Marshall writes: "When walking into Hartley

one day I captured an example of a small species as it was running on the path in the hot sunshine, investigating the external tunnelling of some termites. It seems probable that these insects will prove to be their chief food." And, again, "I frequently watched the diurnal species of *Solpuga* [*S. sericea*] on the Umfuli, while they were out hunting. They run along at a great pace, but if undisturbed rarely keep up the speed for more than 30 to 60 seconds, when they will rest for a few seconds, usually in the shade of a tree-trunk or under a projecting stone or dead leaf. If there happens to be a small hollow where they stop, they always depress their bodies into it so as to keep the abdomen flat on the ground. After a short rest they suddenly rush off again without the least warning. Often they will stop in mid-course and suddenly begin hunting and feeling round a small spot. This behaviour always reminds me of a dog checked in its course by the scent of some bird or other animal, and I have often wondered if these Solpugas hunt by scent, for their eyes, though well adapted for seeing an enemy from above, would hardly seem to be of much use in detecting small insects on the ground. When running this species [*S. sericea*], with its grey colour and the very long white hairs on the hind legs, looks like a bit of thistle-down blown along the ground. I have several times seen them ascend the trunks of trees to a height of ten to fifteen feet, and have often noticed them catching those small thick-set jumping spiders [Attidæ], and less frequently small moths and beetles. But, in accordance with my anticipation, I find that they are very fond of termites. The only ones I have seen them eat belong to a small species which makes no mound, but builds mud tunnels along the surface of the ground among dead leaves, sticks, &c. When the Solpuga comes across such tunnelling it examines along it carefully, then suddenly breaks through the mud and extracts a termite, the presence of which it detects, I suppose, by either hearing or touch."

Concerning the venom of these creatures the evidence is conflicting. "A Kafir boy declared them to be very poisonous, and said he had known of Kafirs dying from the bite. One of my Kafirs recently showed me his hand, which he declared had been bitten by the large brown nocturnal species [*S. Darlingii*] ; it was very much swollen and painful and did not subside until the fourth day. On the other hand, Mr. J. M. Hutchinson, of Estcourt, Natal, has kindly made experiments on the bite of the common Solpuga there [*S. hostilis*, White] and finds it to be quite harmless, the forceps being unable to pierce the tenderest skin."

I take this opportunity of publishing the description of a new species, apparently belonging to the genus *Blossia*, one of the Solpuginæ :—

Blossia rufescens, sp. n. (Figg. 3–3 *a*.)

♂. *Colour* of mandibles, head-plate, and abdominal terga a rich purplish brown; palpi, with the exception of the basal half of the femur, of the same colour; first and second legs almost entirely pale yellow, slightly infuscate at the extremity of the femora; femur, tibia, and proximal end of protarsus of third and fourth legs also purplish brown; the entire lower surface of the body, as well as the coxæ and trochanters of all the appendages and the tarsi of the legs, clear pale yellow.

The entire upperside of the body and limbs covered with a coating of very short, close-set, usually erect stiff hairs; the lower side of the abdomen clothed with longer silky white hairs. The ocular tubercle furnished with thick pale-coloured bristles; similar bristles present on the sides of the head-plate and on its upper surface in small numbers, on the upperside of the mandible, and on the sides of the thoracic and anterior abdominal terga.

Mandibles elongate, somewhat as in *Cleobis*, the stridulating-ridges long and strong; the lower fang armed with three teeth, the median of which is small; the upper armed with eleven sharp teeth, the third from the apex being small, the outer series at the base of the mandible composed of three teeth; flagellum membranous, its margins curled over, pointed posteriorly (fig. 3).

Palpi long and stout, much longer than the third leg, its trochanter armed above with a few spines; femur spinous internally at the apex; tibia and protarsus armed below with two rows of short spines. *Legs* with their trochanters spinous above; the femora with a few short scattered spinules; tibiæ and protarsi, except of the first leg, also spiny; claws of the first leg long; all the tarsi one-jointed, curved.

Second abdominal segment with two clusters of four or five bacilliform hairs, one cluster on each side of the stigmatic apertures.

Measurements in millimetres.—Total length 19; length of mandible 4, of palp 19, of first leg 11·5, of second 10, of third 13, of fourth 24.

Loc. Shaik Othman near Aden (type), also Aden. Two examples obtained by Colonel Yerbury in the winter of 1894–95.

This new species certainly differs from *B. spinosa*, Simon, the type, and hitherto the only known representative of the genus, at least in having the legs strongly rufescent. *B. spinosa* (Ann. Soc. Ent. France, 1880, p. 400) was obtained near Alexandria. It must be added that Simon gives as a character for his genus the fact that the tarsi of the fourth leg are bisegmented. I cannot, however, distinguish two joints on these tarsi in my specimen.

XXVI.—*Contributions from the New Mexico Biological Station.*—No. II. (continued). *On a Collection of Diptera from the Lowlands of the Rio Nautla, in the State of Vera Cruz.* II. By C. H. Tyler Townsend, F.E.S.

[Continued from p. 33.]

Trichopoda.

At least eight species of *Trichopoda* were secured by me, one of which has already been described in Section I. (*T. tegulata*, Towns., No. 15). In separating these forms, it was discovered that the males, especially in the smaller species, frequently have the tips of the foot-claws broken off, some specimens not having a single claw-tip remaining. But they are always broken evenly and at a uniform length, so that the specimens present the appearance of being a distinct form with peculiar claws. Such is, of course, not the case. An examination shows that the male claws become abruptly more slender just before the black hook-like tips, and it is at this point that they break, leaving a straight yellow claw perfectly blunt at the tip. These injuries are perhaps received in pairing.

It should be mentioned that in most *Trichopodas* the female claws are quite evenly curved and not greatly elongate, with a hook-like curve at extreme tip, and yellow with tips rather widely black. In the male the claws are elongated, almost straight, less conspicuously black at tips, which are abruptly bent hook-like at extreme ends. The leverage of the claws on the bent tips causes the fracture of the latter. *T. phasiana*, sp. n., is a notable exception in colour of claws, which are black, while the form of the claws is the same as above described. In *T. histrio*, on the other hand, the claws are not so elongate, yet nearly straight, while their coloration agrees with that of the other species of the genus.

The yellow colouring of the wings, which I had previously considered to be a distinctive sexual character in the male, I

find to vary greatly, being nearly or quite obsolete in some males. The supposed characteristic black on tip of the female abdomen is often subobsolete or wholly wanting.

Size is another character that cannot be relied upon in this group, which seems to approach the nearly allied family Conopidæ in this respect. In some species of *Zodion*, for example, the disparity in size is sometimes very great. I have two specimens of the same sex (male) of *Z. splendens*, one of which is at least five times as large, bulk for bulk, as the other, and yet does not differ appreciably otherwise (see forthcoming papers on Diptera of the Organ Mountains and Diptera of the Mesilla Valley, N.M.).

The scutellum is often subtranslucent, more or less pollinose, so as to appear nearly concolorous with the yellow or reddish abdomen in species with such colours prevailing, rather than with the thorax. This character cannot be trusted, as it is changeable in the same specimen, according to age, degree of preservation, &c. Moreover, there are all gradations in specimens in this respect, so that no separation can be made.

The form of the abdomen is not always constant as a sexual character. Females of the smaller forms often approach the male in the wider subflattened abdomen, while some males even boast the subcylindric abdomen of the female. In all cases of doubt as to sex, the only criterion to be depended upon lies in the sexual organs themselves.

The forms of *Trichopoda* exhibit such a range in size, coloration of wings, abdomen, &c., that it is likely that many of the older names will have to be classed as synonyms, or continued only to mark varieties. The above remarks on colour variation apply more particularly to the smaller forms, *pennipes* and var. *pilipes*.

The following table of species and varieties of *Trichopoda* includes only the forms, and sexes of those forms, known to me from examination :—

Table of Species of Trichopoda.

Males.

1.	Wings with only a narrow internal border, hyaline	5.
	Wings with at most the costal half coloured, the inner half or more clear.....	2.
2.	Abdomen black, with a large pale yellow spot on each side at base	*phasiana*, sp. n.
	Abdomen brown or black, without such spots, golden pollinose on apical segments.	3.

3. Costal half of wings fuscous, without yellow; pollen of abdomen divided by a median stripe	4.
Nearly all of costal half taken up with yellow, leaving but little fuscous; no median abdominal stripe dividing the pollen	*histrio*, var. *indivisa*, var. n.
4. Segments four and five each with an interrupted golden-yellow pollinose fascia, third segment without	*histrio*, Walk. Typical form.
Segments three, four, and five, and sometimes also the anal, with such fascia	*histrio*, var. *trifasciata*, Lw.
5. Wings with yellow or milky-white; if with no white, at least with a distinct trace of yellow near costa	6.
Wings wholly black except inner border, without yellow; abdomen mostly reddish yellow, sometimes dark at tip; mesoscutum with postsutural golden markings.	*pennipes*, var. *pilipes*, Fabr.
6. Wings milky-radiate on a yellow or fuscous background (*formosa* and vars.)	8.
Wings not so	7.
7. Wings with a more or less distinct yellow patch on costal portion, never approaching tip of wing; abdomen reddish yellow, with no blackish unless at tip	*pennipes*, Fabr. Typical form.
Wings yellow on costal portion, nearly approaching tip, the yellow bordered behind by fuscous, which takes up the middle of the wing lengthwise; abdomen yellow with black on base, continued posteriorly in a median stripe	*subalipes*, Towns.
8. Mesoscutum with postsutural golden-pollinose markings	9.
Mesoscutum without such markings	10.
9. Milky radiations of wings very conspicuous with the yellow less apparent, abdomen rather strongly purplish; hind femora strongly ciliate on apical half: robust form	*formosa*, var. *radiata*, Lw.
Wings conspicuously and broadly yellow, with the milky radiations less apparent; abdomen orange-yellow, more or less dark on median line and tip	*formosa*, var. *inconstans*, Wd.
10. Wings with the milky radiations on a fuscous ground, with little if any yellow; hind femora ciliate apically, abdomen reddish shading to purplish	*formosa*, Wd. Typical form.
Wings with a yellow patch, hind femora	

not ciliate; abdomen orange-yellow or orange, never inclining to purplish ..... 11.

11. Bases of femora broadly reddish yellow; wings only lightly milky-radiate with a yellow patch near costa ..... *formosa*, var. *aurantiaca*, Towns.

Femora wholly black; wings tawny and milky-radiate, the tawny blotch-like .... *formosa*, var. *hirtipes*, Fabr.

Females.

1. Wings black only on costal third, the rest abruptly clear; abdomen black, with two large basal spots yellow ..... *phasiana*, sp. n.

Wings abruptly limpid only on narrow internal border ..... 2.

2. Wings wholly black except inner border, without yellow colouring ..... 3.

Wings with more or less yellow, at least distinctly yellowish near costa ..... 9.

3. Body wholly black in ground-colour..... 4.

Not black species ..... 6.

4. Tegulæ rich yellow, alulets half white and half black ..... *tegulata*, Towns.

Tegulæ and alulets not so coloured ..... 5.

5. Hind femora not ciliate, legs and palpi black: smaller form ..... *lanipes*, Fabr. Typical form.

Hind femora subciliate apically, palpi and bases of femora more or less yellowish: large form ..... *lanipes*, var. *tropicalis*, var. n.

6. Hind femora strongly ciliate on posterior half ..... 7.

Hind femora not at all ciliate..... 8.

7. Mesoscutum with postsutural golden-pollinose markings; abdomen red, with black tip ..... *formosa*, var. *radiata*, Lw.

Mesoscutum without postsutural golden; abdomen red, with darker median line .. *formosa*, Wd. Typical form.

8. Palpi and bases of femora black or brown; abdomen usually distinctly black on apical portion ..... *formosa*, var. *hirtipes*, Fabr.

Palpi and bases of femora reddish yellow; abdomen more or less dilute blackish or brown on tip ..... *pennipes*, var. *pilipes*, Fabr.

9. Wings yellow on whole costal border, the yellow bordered internally with faint or dilute fuscous gradually giving way to limpid; hind femora ciliate apically .... *subalipes*, Towns.

Wings with a yellow patch near costa, sometimes subobsolete, but distinctly traceable; hind femora not ciliate ..... *pennipes*, Fabr. Typical form.

36. *Trichopoda formosa*, var. *radiata*, Lw.

Two males, San Rafael, July 2 and 4. On flowers of the *Cordia* sp.

Length 15 to 17 millim.

This is the largest known form of *Trichopoda*, the var. *radiata* being even more robust than the typical *formosa*. The larger one of these specimens is especially robust, with the wing coloration pronounced and the tibial cilia strongly developed. Not only are the hind tibiæ ciliate in these forms, but the cilia encroach very largely on the hind femora, the upper and lower edges of the distal third to half being ciliate, as Wiedemann has described. These apical cilia of the hind femora are more or less developed in other of the larger species of *Trichopoda*, but in none so strongly as in the present form *radiata*. The wings are rather conspicuously yellow in these specimens, in a broad elongate subcostal patch extending from near base to a point halfway between tips of first and second veins. But the milky colour is still more conspicuous, radiating from the base of the wing over the yellow and fuscous alike. The abdomen is obscure brownish red with a purplish tinge, the apical segment reddish yellow, which represents more nearly the colour of the abdomen in life. The palpi and bases of femora are reddish yellow.

T. radiata is doubtless to be considered conspecific with *formosa*. It must be preserved as a good variety on its general greater robustness, and the presence of the golden-pollinose markings of mesoscutum behind transverse suture, which are apparently lacking in the typical *formosa*, a character which Loew failed to point out as differential. The somewhat lighter palpi and bases of femora, and more purplish abdomen of male, can hardly be used to distinguish it. Specimens of *Trichopoda* vary to a considerable degree. Wiedemann's specimens of *formosa* are described as having the thoracic lines white, the outer ones a little golden. In the species with conspicuous tibial cilia, these lines are normally deep golden yellow. But I have seen them wholly white, and even faint. I do not consider the colour of these lines of any importance. It is not a sexual, and it cannot be considered even a varietal character. In the smaller one of the present specimens, the deep golden pollen of mesoscutum behind the suture is highly developed, consisting of a prescutellar transversely-elongate subquadrangular area, with lateral edges continued forward in a narrow line on each side to suture, while posteriorly it spreads over the basal half of

disk of scutellum, though separted from latter by the silvery hind margin of thorax. In the other specimen this postsutural golden pollen is so faint as to be apparent only in a golden shade next the silvery hind margin of thorax, with none on the scutellum. Loew mentioned the postsutural golden in his description of *radiata*, but failed to notice that, from Wiedemann's description, it is evidently lacking in *formosa* and therefore of use as a differential character.

Neither Loew nor Wiedemann mentioned the yellow of the wings, which doubtless varies much and may even be obsolete in some specimens. Wiedemann evidently means the first basal cell, when he says, "Mittel oder Speichenzelle" milky. This is the case, at least. The present specimens agree with Loew's description in the milky radiations. Wiedemann says that these radiations follow the *inner* border of the longitudinal veins, which is true with the exception that it is the outer border in the case of the last section of fourth vein. The second costal cell is wholly milky. The specimens of *radiata* mentioned by me in Proc. Ent. Soc. Washington (ii. pp. 138–139) were taken at Dixie Landing, Va., early in July, on flowers of sumach (*Rhus* sp.). The previous specimen from same locality, mentioned in same Proceedings (i. p. 255), taken August 19, was from flowers of tansy (*Tanacetum vulgare*, L.).

37. *Trichopoda formosa*, var. *inconstans*, Wd.

Three males, San Rafael, July 2, 3, and 6. On flowers of the *Cordia* sp.

Length 13 to 15 millim.

I would refer these specimens to *aurantiaca*, Towns. (Proc. Ent. Soc. Wash. ii. p. 140), which should be ranked as a variety of *formosa*, were it not for the conspicuous golden-yellow markings back of the suture, which are absent in *aurantiaca*. It would fit the description of *luteipennis*, were it not for the distinct broad area of black extending from base to tip of wing broadly bordering the yellow posteriorly, and the black colour of the legs. It may best be referred to *inconstans*, which also should be considered a variety of *formosa*.

The present specimens agree with the description of *inconstans* in all except the triangular blackish areas of second to fourth abdominal segments. These are hardly perceptible, but still there seems to be a trace of them. Such markings can be of little use in separating dried specimens, being variable and doubtless due to the coagulation of the juices of

the abdomen beneath the tergum. Therefore I feel quite safe in referring these specimens to *inconstans*, since the peculiar characters of the wings and thorax agree so well with the description. As a variety it differs from the typical *formosa* not only in the characters of *aurantiaca*, but further by the postsutural golden markings of the mesoscutum.

38. *Trichopoda lanipes*, var. *tropicalis*, var. n.

One female, San Rafael, June 28. On flowers of the *Cordia* sp.

Length $13\frac{1}{2}$ millim.

This is a large form of *lanipes*. Fabricius's and Wiedemann's specimens measured about 9 millim. I have seen specimens of the smaller form, here considered to be the typical *lanipes*, which were only a little larger than normal specimens of *pennipes*. The present specimen has the deep golden pollen of sides of front clear and pronounced, being pointed-triangular in shape, filling out the space between frontal vitta and eye-margins anteriorly, and continued indistinctly backward along orbits nearly as far as vertex. The lines of thorax are distinctly golden, though inclining to whitish. Abdomen has a uniform bluish cast, apparently from a very thin covering of silvery pollen over the black ground-colour, but is nevertheless shining. Femora are yellowish red at base. Palpi brownish yellow. Otherwise the specimen agrees perfectly with the descriptions of Fabricius and Wiedemann. It shows some short cilia on upper and lower edge of hind femora apically.

The characters belonging to this variety are, in the main, its greater size, combined with the lighter palpi and bases of femora, and the femoral cilia. It is doubtless a tropical variety of the smaller typical form, which was from Carolina. I have seen other large specimens, from Mexico and South America, apparently belonging to this variety.

T. plumipes, Fabr., is doubtless to be considered another variety of *lanipes*, differing principally in the rust-colouring of scutellum and femora. It is small like the typical *lanipes*.

T. lanipes, presumably the typical form, has been recorded by Giglio-Tos (Ditt. Mess. iii. p. 6) from Cuautla (wrongly spelled with an *n*), which is in the State of Morelos. The specimen was collected by Saussure. In the same place, Giglio-Tos gives New Mexico as a locality for *lanipes*, referring to my paper, in which I gave no locality whatever, but merely remarked on the affinities of the species. He has similarly recorded *pennipes* from New Mexico, referring

to me as authority, while in my paper I stated that it was found "over the eastern half or more of the United States and in Mexico." He has still further, in the same manner, given New Mexico as a locality for *Ocyptera dosiades*. The paper of mine referred to ("Notes on North-American Tachinidæ, I.," Proc. Ent. Soc. Wash. ii. pp. 134–146) was published while I was in Washington, and all of my specimens therein mentioned, unless otherwise stated, were taken in the District of Columbia. These errors of locality should not be perpetuated, as they are very misleading with regard to the geographical range of species. No specimen of *Trichopoda* has ever been known, by any chance wind or shift of fortune, to occur in New Mexico! Neither does the genus *Ocyptera* occur there to my knowlege.

N.B.—It should be pointed out that in Bellardi, Sagg. Ditt. Mess., and Osten Sacken, Biol. C.-A., Dipt., the locality Cuautla is wrongly spelled, the mistake being doubtless due to the printers and proof-readers. The mistake has even become incorporated into dipterological nomenclature, in the name *Dasypogon cuautlensis*, Bell. (Ditt. Mess. ii. p. 67). The specific name should be amended to *cuautlensis*. Cuautla is pronounced *Kwah-oot'-lah*.

39–40. *Trichopoda pennipes.*

Typical form and var. *pilipes*, Fabr.

I refer here twenty-four specimens, sixteen males and eight females, all San Rafael, March 9 to July 18. All except the March 9 specimen (male), and one June 18 (male), were taken on flowers of the *Cordia*, sp., from June 30 to July 18.

Length of males 6½ to 11 millim., of females 7 to 10 millim.

Notwithstanding the great variation in size, as well as considerable in wing-coloration, I must locate all of these specimens in this species. The form without yellow on the wings may be continued for the present as a variety under the name *pilipes*, Fabr., the description of which applies well. This is apparently the form which recent writers (Roeder, Wulp, and Giglio-Tos) have referred to under the name *pyrrhogaster*, Wd., which I consider a synonym of *pilipes*, Fabr. The proper separation of *pennipes* and *pilipes* can be known only by the capture *in coitû* of numerous specimens of both forms.

Nearly all of the present specimens have at least a tinge of brown on the tip of the abdomen, but this cannot be said to be general in either sex. The colour of the scutellum

varies from reddish yellow to black. It is black in nearly all of the females, while in most of the males it is lighter. The females are all quite constant in being without the postsutural golden markings of mesoscutum, or with only a trace of them. These markings consist in these forms of three golden lines joined posteriorly by a transverse line. They are constant and well defined in all of the males. The males vary in wing-colouring from specimens having a large yellow patch extending along costal margin from base of wing two-thirds way to tip, to others in which the yellow is subobsolete or entirely wanting; while the females, though usually without any yellow, in several cases show a trace of it on the wings. The femora in all the specimens are more or less broadly yellowish at base. Palpi reddish yellow. The orbital margins in all the females are silvery pollinose, in the males golden pollinose. The claws of both sexes, especially the female, vary in length, but they are usually comparatively longer in the male. The female abdomen is usually narrowed at tip. The abdomen of all the males is distinctly truncate apically, usually more or less flattened, and rarely subcylindrical. But in this connexion the male taken June 18 deserves special mention. It has the elongate tapering subcylindric abdomen of the female, is entirely without yellow on the wings, and has the postsutural golden markings less distinct; but it has the claws characteristic of the male, and possesses the male hypopygium. This difference in shape of the abdomen may be abnormal in this specimen. Another male, with well-marked yellow on the wings, approaches it somewhat in this respect.

Typical var. *pennipes*, Fabr.—The specimens of the above which I refer here are as follows: Thirteen males, one each, March 9, June 30, July 1, 2, 3, and 17; two each, July 4 and 5; and three, July 6. Two females, July 4 and 18. Length 6½ to 10 millim.

Characterized by having a more or less distinct patch of yellow on wings in both sexes, less distinct in the female. Scutellum generally lighter in coloration. Wings appearing less pronouncedly black. Abdomen rust-yellowish.

Var. *pilipes*, Fabr.—The specimens which I would refer here are: Three males, June 18 (the ones specially mentioned above), July 4 and 10; six females, all July 3, except one July 2.

Length 7 to 11 millim.

Characterized by having no yellow on wings in either sex, or hardly a trace in the male. Scutellum generally shining

black. Wings pronouncedly black, except narrow limpid hind margin. The abdomen is generally, especially in the female, more distinctly orange-coloured.

This somewhat arbitrary separation of these two forms must be borne with till actual field observations prove their true relationships.

Both *pennipes* and *pilipes* were described by Fabricius and Wiedemann from the male, and the descriptions both apply well in regard to the postsutural golden markings of mesonotum. As before stated, these markings are quite constantly characteristic of the male in both varieties. *Phasia jugatoria*, Say, *Ocyptera ciliata*, Fabr., *T. pyrrhogaster*, Wied., and *T. haitensis*, Desv., therefore all become synonyms of *T. pilipes*, Fabr., since all are dark-winged forms. Although Wiedemann designated the female in his description of *T. pilipes*, it is quite certain, from his diagnosis, that he was describing the male. The others seem all to have been described from the female (not including *pennipes*).

T. flavicornis, Desv., is another variety of *pennipes*, chiefly distinguished by its yellowish antennæ.

41. *Trichopoda histrio*, var. *indivisa*, var. n.

One male. San Rafael, June 30. On flowers of the *Cordia* sp.

Length 9 millim.

Fifth and sixth segments of abdomen thickly and densely deep golden-yellow pollinose. Fourth segment thinly so, showing a continuous golden surface only when viewed from in front parallel with the plane of the tergum. Second and third segments showing some silvery pollen when viewed in same way. No fasciæ, therefore, are shown on the abdomen, but a continuous pollinose surface, without interruption to the pollen on the median line. The fuscous of costal half of wing is very largely yellow, except at its base, tip, and on its posterior border, where it is more deeply smoky. Otherwise agrees well with Loew's description of *trifasciata*. It is thus seen that this form varies widely from the typical *histrio* in the pollen of abdomen, doubtless representing a Mexican or neotropical variety.

T. trifasciata, Loew, may be continued as a variety of *histrio*. Walker's specimen, which must be taken as typical, possessed only two abdominal fasciæ. It will be well to designate the form with three and four fasciæ by Loew's name.

The forms of *histrio* are entirely destitute of cilia on the hind femora.

I suspect that *T. umbra*, Walker, from Venezuela (List, p. 698), is another variety of *histrio*. It seems very probable from the description of the brown bloom on abdomen, becoming tawny on last segment, with a median vitta separating it. The specimen described was a female.

PENNAPODA, subgen. n.

Differs from normal forms of *Trichopoda* in the abdomen being nearly the same shape in both sexes, subcylindrical, rounded at tip, narrowed a little at base, not flattened-subquadrate in male. Hind tibiæ much less strongly ciliate, with weak cilia on apical half; claws of female very short, those of male elongate but black. Wings hyaline on more than inner half. Apical cell closed in margin. Characters of the vibrissæ and frontal bristles same as in *Trichopoda*, but the bristles somewhat stouter. It has a distinct facies.

Type *T. phasiana*, sp. n.

The forms of *Trich. histrio* connect this subgenus with *Trichopoda* proper. They are intermediate between the two, very much approaching *Pennapoda* in certain characters, but yet more nearly related to *Trichopoda* in general facies.

42. *Trichopoda phasiana*, sp. n.

Ten males and six females. San Rafael, both sexes taken from June 30 to July 13. All on flowers of the *Cordia* sp.

Length of male 7 to 8 millim., of female 6 to 7 millim.

Male.—Face silvery, with a golden shade; orbits narrow, distinctly golden, extending nearly to vertex. Rest of front taken up with the very wide soft black frontal vitta. Antennæ blackish or brown, second joint below and base of third more or less yellowish, third joint not twice as long as second. Palpi yellowish. Mesonotum golden-pollinose, with three wide black vittæ, interrupted at suture, and more or less joined behind suture, sometimes in one transverse piece of black irregularly and widely bordered behind by golden. Sometimes the middle black vitta in front of suture is split from behind by a line of golden. Scutellum black, silvery pollinose except at base. Pleuræ silvery pollinose. Abdomen black, with a large oval pale yellow spot on second and third segments on each side, extending from near anterior margin of second to within about same distance (one fourth to one sixth length of segment) from posterior margin of third, notched on inner side, more or less obliquely extended posteriorly, the median black between the two spots being much wider on third segment than on second. Fourth and

fifth segments showing more or less distinctly a slight silvery pollen, rest of abdomen less distinctly so. Black of abdomen more or less shining through the pollen. Legs black, proximal third or fourth of hind femora yellow; coxæ and trochanters reddish yellow, with the dense silvery pollen of pleuræ extending over them. Hind tibiæ short ciliate on apical half. Pulvilli and claws elongate, latter wholly blackish, often with tips fractured and missing, as mentioned in *Trichopoda*, pulvilli whitish or yellowish fuscous. Wings evenly black along whole costa to tip for about one half of their width, the black filling out all three basal cells, but with apical cell clear or a little clouded across tip. Rest of wings nearly clear, subhyaline, sometimes faintly tinged with dilute smoky. Tegulæ very large, white, sometimes watery whitish; alulets small, about one sixth to one eighth size of tegulæ, white, sharply contrasted in colour with rest of wing.

Female.—Differs in face and orbits being entirely silvery white, not golden. Abdomen slightly less broad; abdominal spots more narrowed oblique, not so extensive on dorsum of third segment, not notched on inside, thus leaving the median black evenly and rapidly widened posteriorly from its least width at or behind middle of second segment; fourth and fifth segments more distinctly silvery pollinose, rather conspicuously so in comparison with the males. One male, however, has the abdominal markings and pollen almost as in the female. Claws and pulvilli very short. Sixth abdominal segment much less apparent.

Phania simillima, Fabr., Wied., apparently belongs to the subgenus *Pennapoda*, and is thus nearly allied to the present species. Its greater size (about 10 millim.), the reddish-brown instead of pale yellow abdominal spots, and the reddish-brown bases of femora and hind tibiæ preclude the identification with it of the present form.

43. *Cistogaster occidua*, Walk. (syn. *C. divisa*, Lw.).

One female. San Rafael, March 9.

Length 5 millim.

This specimen is perfectly normal, except that the pollen of mesonotum and front has a brassy tinge, and the silvery fascia is present on second segment of abdomen. Apical cell extremely short, petiolate.

In the first section of this paper I recorded a male specimen of *C. immaculata*, Macq. (No. 16). I must again, for the last time, correct my statement on the synonymy of these species. The remarks there should read as follows:—The

species possessing the normal female will be known as *C. occidua*, Walker. Loew's name *divisa* will remain a synonym of the latter. It is to be borne in mind that the form with the aberrant (dimorphic or male-like) female was described in the male by Macquart. The form with the normal female was described in the female by Walker, and later in the male by Loew. Therefore it is clear enough that Walker's name must stand.

As this subject has become somewhat complicated, I introduce the following table of males and females of *Cistogaster* known to me, which will remove all doubt and possible misunderstanding with regard to the separation of these species.

Table of Cistogaster.

Females.

1. Mesonotum and scutellum shining black, without pollinose vittæ, only the humeri pollinose; sides of front shining black, hardly at all silvery; abdomen without distinct pollinose vitta or cross-bands, apical cell longer petiolate	2.
Mesonotum with three pollinose vittæ, scutellum pollinose; sides of front conspicuously silvery, well defined; abdomen black, with a median vitta and two or three fasciæ pollinose; apical cell shorter petiolate or closed in margin	*occidua*, Walk.
2. Abdomen distinctly red on sides, especially anteriorly; third and fourth segments with pollinose reflections on each side	*immaculata*, Macq.
Abdomen wholly deep shining black, with or without pollinose reflections on apical segment.	*Pallasii*, Towns.

Males.

A longitudinal fuscous stripe on abdomen in connexion with the median pollinose vitta; abdomen bright ferruginous, third and fourth segments more or less pollinose	*occidua*, Walk.
Fuscous stripe of abdomen wanting, the median pollinose vitta more or less distinct; abdomen more yellowish, the third and fourth segments with pollinose reflections on each side	*immaculata*, Macq.

Williston's *C. insularis*, female, from St. Vincent, is apparently a specimen of *C. occidua*, Walk. (as restricted in the table), with the median vitta obsolete on second segment. His *insularis*, male, is probably *immaculata*, Macq.

C. melanosoma, Wulp, is, so far as can be said from a two-line description, the same as *Pallasii*, the apical segment being distinctly pollinose instead of obsoletely so.

C. subpetiolata, Wulp, is a typical but small female of *occidua*, excepting only that the pollinose vitta and fascia of

second segment are obsolete, as in Williston's specimen from St. Vincent. No reliance can be placed on the character of the apical cell being petiolate, nor can the extent of the pollen on the abdomen be relied upon. These forms might be considered varieties, though it would be hard in that case to decide where to stop defining varieties and recognize mere individual variations.

C. propinqua, Wulp, if a female as designated, is at least a good variety, bearing the same relation to *occidua* that exists between *immaculata* and *Pallasii*. But the colour of the antennæ and palpi is of comparatively no importance.

C. griseonigra, Wulp, is probably a variety of *Pallasii*. But it is useless to speculate on descriptions not exceeding two to four lines, except in so much as they indicate what is still to be found and described. I will not attempt an examination of Wulp's male *Cistogasters*, which all seem easily referable to either *occidua* or *immaculata*, though, of course, nothing can be said of them in their present incompletely characterized state. It is greatly to be regretted that such a long delay, though doubtless unavoidable, in the appearance of the parts of the 'Biologia Centrali-Americana' should have caused the publication separately of such short diagnoses of species. The diagnoses, if presented separately in advance, should be full and complete.

It may be noted here that *Cistogaster* is another of those tachinid genera which are not at present known to occur in New Mexico.

Phaniidæ.

44. *Xanthomelanodes arcuata*, Say.

Four males and four females. Paso de Telaya, one female, March 28, and two females, April 7. San Rafael, one female, June 20, in sweepings. The males, all San Rafael, on flowers of the *Cordia* sp., June 29 and July 5, 12, and 16.

Length of males 5 to 7 millim., of females 5 to $6\frac{1}{2}$ millim.

The allied *X. atripennis* was described by me in Notes N. Amer. Tachin. i. pp. 145–146, as a *Wahlbergia*. The latter genus should be known as *Besseria*. The present forms are very distinct from *Besseria*, lacking entirely the peculiar female abdominal characters of that genus, besides differing widely in other respects.

The present specimens of *arcuata* vary considerably in size, two of the males (July 5 and 16) and two of the females (March 28 and June 20) measuring only 5 millim.; but they hardly differ in coloration, and are without doubt all the same

species. They differ from my description of *atripennis* as follows:—

Whole face and sides of front of female silvery-white pollinose. The frontal stripe is sometimes but little widened anteriorly at base of antennæ. Mesonotum of male in front of suture deeply golden-yellow pollinose, with two median vittæ and a more or less elongate spot near suture velvet-black, the vittæ more or less united, except at posterior ends. In one of the smaller males the markings of mesonotum appear silvery with a golden shade. The elongate lateral spots are about half as long as the vittæ, or little more, and represent another pair of vittæ anteriorly obsolete. These black markings may be so approximated as to give the appearance of a golden fascia along the suture, with its anterior border irregular or jagged, as given in my description of *atripennis*; though this is not the case in the present specimens, and probably not in this species. The golden of hind border of mesoscutum is more or less extensive, and may be rather silvery. In the female the vittæ and golden pollen of mesonotum are very faint, except that the humeri are distinctly and rather broadly golden, following inward along front border of suture a short distance. The rest of thoracic dorsum appears more or less shining black, thinly shaded with silvery, the vittæ sometimes being faintly outlined. Scutellum is more or less faintly silvery. The males agree fairly well in colour of abdomen with description of *atripennis*. In the female the black of abdomen is much more extensive, leaving only a large more or less irregularly defined oblong lateral yellow spot on second and third segments. The black covers third segment in a large triangle, and on second segment appears as a narrow but sometimes much widened median vitta. In the female only the basal half or third, or even less, of hind femora is yellow; in male sometimes only basal half; other femora often only narrowly yellow on bases. (See my paper, above referred to, p. 143, for the colorational and abdominal differences in the sexes of *arcuata*, drawn from Illinois specimens.) The variation in colour of bases of femora just mentioned cannot be depended on as a specific character. Claws and pulvilli of female short. The antennæ vary a little in length, from slightly more to considerably more than one-half length of face. The sides of abdominal segments in female are conspicuously silvery pollinose in oblique lights. The frontal bristles are moderately strong, stronger than in Giglio-Tos's figure of *X. articulata*. Wings quite abruptly hyaline on somewhat more than inner half. Abdomen of male yellow, with basal segment more or

less completely black, second and third segments with a median black line always interrupted at sutures and often very indistinct, fourth segment with a black triangle, fifth wholly blackish. The specimens agree very well with Say's description, which, however, is very brief.

X. atripennis is closely allied to this species, differing only in the wings being almost wholly black, and the abdomen of male (female unknown) almost wholly yellow, the rust-brownish markings often subobsolete. Say's specimen of *Phasia atripennis* must have been a male, in which the pre-sutural golden of mesonotum was not so much developed as in the present specimens, and with the median row of blackish spots obsolete. This species is known from Indiana, District of Columbia (*Towns.*), and Florida. My specimens from the District of Columbia were taken on the flowers of *Aster* sp.

X. arcuata is now for the first time recorded from Mexico. It is known elsewhere only from Indiana and Illinois.

Both of these species are quite different from *X. articulata*, Wulp and Giglio-Tos, to judge from the latter's figure and description, the antennæ being much elongate in *articulata*, and the abdominal segments bearing a lateral marginal macrochæta, which characters are not possessed by *arcuata* and *atripennis*.

Wulp's short descriptions (Tijdschr. voor Ent. xxxv. 1892, p. 188), supplemented by Giglio-Tos's description and figure (Ditt. Mess. pt. iii. pp. 4–5, pl. fig. 12), place the genus *Xanthomelana* with sufficient certainty. The name should, however, as I have pointed out (Can. Ent., July 1893, p. 167) be changed to *Xanthomelanodes*, the other name being rightly precluded by its close similarity to *Xanthomelon* in Mollusca, even though the derivation be not identical. The petiole of apical cell, as I have mentioned in the description of *atripennis*, is rather long, and not short as described by Wulp in his generic diagnosis. I believe that the genus should be restricted to the forms similar to *arcuata* and *atripennis*, with their venation; with antennæ short, having second and third joints nearly equal in length; and with the front wide in both sexes. The two species *anceps* and *articulata*, included in the genus by Wulp, are disturbing elements in its proper characterization and should be excluded. Wulp says nothing of the genital characters, by which it is very easy to distinguish the sexes. The male abdomen is blunt and laterally compressed apically, and the hypopygium is easily seen on the underside near tip. The female abdomen is more pointed at tip, and the segments are narrowed and drawn in. This genus belongs in the Phaniidæ.

It seems probable that Wulp's *X. dorsalis*, and perhaps some of his other species, are either identical with or constitute but varieties of *atripennis* and *arcuata*.

Note.—On the underside, at extreme base of abdomen, in both sexes, apparently on first segment, there is to be distinguished, sometimes plainly, sometimes with much difficulty, a transverse swelling or prominence of the yellow integument clothed with some rather conspicuous black hairs. This has nothing whatever to do with the ventral peculiarities of the second segment of female in *Besseria*, which are very different. And while on this subject I may here confirm Mr. Coquillett's maintenance of his genus *Celatoria* as distinct from *Besseria*. The ventral process of the second segment of male in *Celatoria* is wholly different, as are all the other characters. This can at once be seen by comparing the figure of *Celatoria* in 'Insect Life,' ii. p. 234, with that of *Besseria* given by Brauer and Bergenstamm in the 'Muscaria Schizometopa,' i. figs. 288 (head and abdomen of female), and by Coquillett's notes on the characters in 'Psyche,' June 1895, p. 252. *Celatoria* does not belong in the Phaniidæ at all, but in some as yet undetermined and undescribed group of the Tachinidæ.

It may be pointed out that *Wahlbergia brevipennis*, Lw., from Nebraska, is not a *Xanthomelanodes*. Neither is it a *Besseria*. I have had figures drawn of the head and wing of this species, as well as of several other of Loew's unrecognized North-American Tachinidæ, made from the type specimens in the Cambridge Museum, which will be published later in a separate paper. But it may be mentioned here that *Hyalomyia trianguliferа*, Lw., which is one of these species, is not a *Hyalomyia*, but is identical with *Hyalomyodes Weedii*, Towns., which thus becomes a synonym. The species will be known as *Hyalomyodes trianguliferа*, Lw. (see 'Psyche,' April 1893, pp. 429–430). Loew's *Euthera tentatrix* I have taken in New Mexico, on the Jornada del Muerto, in July; it belongs somewhere in the body of the Tachinidæ, s. str. *Xysta didyma*, Lw., and *Himantostoma sugens*, Lw., also belong in the body of the Tachinidæ.

N.B.—I may be accused by some persons of taking up valûable space with useless data in giving the dates of specimens, male and female, separately and in such detail as appears in this paper; but I believe that such data, when exact, taken in connexion with the prevailing meteorological conditions, may indicate much with regard to the life-histories of such insects, concerning which so little is at

present known. This is particularly the case when collecting is done every day for a considerable length of time, and done closely. From June 18 to July 20 I collected daily all the Diptera possible, especial attention being given to the *Cordia* flowers. It has been thought that, in the tropics especially, dates are of little or no consequence; but I observed at San Rafael, during my close collecting daily from early spring to midsummer, that as the season advanced very many species of insects appeared suddenly, where before there had been none at all to be found. This shows that species have their seasons in the tropics as well as in colder latitudes, a fact which is evident enough to anyone who has collected carefully for any length of time in tropical regions.

Hippoboscidæ.

Lipoptena.

Since the time when, in 1823, more than seventy years ago, Say described *Lipoptena depressa* taken from *Cariacus virginianus* in Pennsylvania, no mention has, to my knowledge, been made of further specimens of this genus from America. It will therefore be interesting to know that I secured between one and two hundred specimens from a Mexican white-tailed deer near Paso de Telaya.

45. *Lipoptena depressa*, var. *mexicana*, var. n.

Numerous specimens of both sexes, 153 in all, together with puparia, taken from ventral region, hind quarters, and sides of a white-tailed deer, *Cariacus virginianus*, var. *mexicanus*, March 27. Paso de Telaya.

The specimens agree fairly well with Say's description of *depressa*. The antennæ are yellowish. I can distinguish no brown lines on hypostoma, unless Say and Wiedemann refer to the two halves of the labrum which might have been appressed to the under surface in their specimens, or to the two linear spots above on each side of base of labrum. There are often, doubtless normally, three soft brownish longitudinally-elongate spots on posterior portion of tergum, the middle one the largest and heaviest, and situated a little farther posteriorly than the lateral ones. The middle one is often heightened, and the lateral ones obscured, by the developing larval case or puparium within the abdomen of the female, thus giving the appearance of a single heavy dark spot. All the specimens are wingless, but the wings are represented by well-developed rudiments. The lateral pointed elytra-like

raised portions of the tergum are shaded with soft brown, only the bases and tips being yellowish. My specimens remained in alcohol for nearly a year, so that I cannot give a more detailed colour description. From memory, however, I can say that the soft brown and yellow colours blended so as to give a very pretty effect, and I could hardly describe the insect as generally pale testaceous or yellow. Both Say and Wiedemann, in their descriptions, convey the idea that the tergum of abdomen is unicolorous, whereas in the present form the colour is well contrasted between soft brown and yellow in life, changing to brown and pale yellowish in alcoholic specimens. There is also, as I remember, a creamy bloom on the yellow portions in life, which heightens the colour effect. The legs are yellowish. The thorax has the darker lateral and posterior margins. The specimens vary in length from 2 to 4 millim., the usual size being 3 to $3\frac{1}{2}$ millim. Allowing for brevity in Say's description, and also for the possibly poor condition of his material, it is nevertheless my opinion that these Mexican specimens form at least a good variety of *depressa*.

Twenty-six of the females contain each a black puparium within the abdomen, well formed and nearly ready to escape. Others show it less advanced. Twenty-one of the specimens have a much narrowed form, the abdomen being the same width as thorax, and about the same size as latter. This form represents individuals that have recently emerged from the puparium. It may be noted that in these the lateral elytra-like pieces of tergum are not wrinkled or compressed to any extent; but the rest of tergum, which in the fully developed adult is spatulate and widened behind, is much wrinkled and compressed, indicating its recent escape from the puparium.

The puparium is 2 millim. long; $1\frac{1}{2}$ millim. wide at widest, which is across middle; and 1 millim. thick at thickest, in centre as seen from a lateral view. It is polished chestnut-brown, with a well-defined yellowish stripe around whole edge except at the cephalic end. The cap is shining blackish. Whole puparium is shining, rather short oval in dorsal outline, the cephalic end more tapering; slightly flattened or less convex on ventral surface, so as not to give a symmetrical profile view.

The abdomen of the male is rounded behind, rather entire in outline on posterior edge, hypopygium concealed, genital orifice removed a little from posterior edge of ventral surface. The abdomen of female is truncate behind, the posterior margin rather deeply emarginate on each side of genital

orifice, which is situated on or close to the posterior edge of ventral surface. Anyone desiring to intelligently comprehend the external anatomy of *Melophagus* and *Lipoptena* will do well to study carefully the excellent plate of *Melophagus ovinus* given by Dr. Cooper Curtice, in his work on the 'Animal Parasites of Sheep' (Bureau Animal Industry, U.S. Department of Agriculture, 1890, plate 4).

The male hypopygium in the present species can be clearly made out in a dry mount of the abdomen by the use of a high-power objective. The male organ itself is moderately stout and blunt at tip, rather than pointed as in Dr. Curtice's figures of *M. ovinus*.

Note.—Professor J. H. Comstock, in his new 'Manual for the Study of Insects,' p. 488, states that "the species of the genus *Lipoptera* (*sic*) are winged at first and live on birds; later they migrate to quadrupeds, where they remain, and having no further use for their wings, they lose them." I know not what authority Professor Comstock has for this statement, but I should feel that it was open to question. At all events it cannot be made as a general statement for the genus, for it is clear, from the preceding notes, that the present species breeds, certainly at times and presumably always, on deer; and, judging from the above specimens, which seem to show unmistakably their recent escape from the puparium, it is always wingless.

N.B.—In his recent revised 'Synopsis of North-American Diptera,' Dr. Williston has included *Tricobius*, in the table of Hippoboscidæ, in the section with claws simple. It should be pointed out that *Trichobius* possesses bifid claws (see my description in Ent. News, 1891, pp. 105–106).

XXVII.—*Two new Species of the Genus* Xanthospilopteryx, *Wallengren*. By W. J. Holland, LL.D., F.E.S., &c.

I have recently received several examples of a fine species of *Xanthospilopteryx* from Cameroons which does not appear to be represented in European collections, and thus far has certainly not been described. I take pleasure in naming it after Mr. W. F. Kirby, the veteran student of entomological literature, whose recent monographic revision of the genus is of great value. While visiting the K.-k. Museum für Naturkunde at Berlin the other day Professor Karsch kindly pointed out to me a specimen of an allied species taken by Dr. Pogge in Equatorial Africa. Availing myself of the

kind permission to describe the species given me by Professor Karsch, I find satisfaction in applying to it his name, in grateful appreciation of the kindness shown me during my visits to the museum in Berlin.

Xanthospilopteryx Kirbyi, sp. n. (Fig. 1.)

♂. The front, collar, and thorax are deep black, with the usual spots on the top of the head, the collar, and the patagia. These light-coloured spots are white on the head and greenish yellow on the collar and the patagia. The abdomen is ochreous, shading into brown at the tip, and obscurely marked with brown bands on the lower side of each annulus. The legs are black, marked with fulvous. The wings are deep

Fig. 1.

black, with the larger spots yellow (distinctly *pale Naples yellow*), and the smaller spots at the base iridescent greenish yellow. The fringes of the primaries are white at the apex and of the secondaries white throughout. The secondaries are heavily clothed with long hairs on the inner margin, and the basal tract is marked by a couple of streaks of deep black running outwardly parallel to the veins. The underside is much as the upperside so far as the markings are concerned, but the light-coloured portions of the secondaries are distinctly of a reddish-ochreous cast.

Expanse 94 millim.

Type in coll. Holland.

Xanthospilopteryx Karschii, sp. n. (Fig. 2.)

♀. Front black; eyes brown. The thorax and abdomen are black, with the usual spots on the head, collar, and patagia.

These spots are bluish white. There are a few pale fulvous hairs at the end of the abdomen. The legs are black, marked with white. The fore wings are deep black, with the fringe at the extreme apex white. There are a few pale blue spots at the base of the wing and one of the same colour at the end of the cell. There are nine dark lemon-yellow spots on the fore wing, as follows:—a broad subapical spot, partly subdivided internally by the nervules, which are marked by black scales on the side of the spot toward the base of the wing; a large subquadrate spot near the end of the cell; another larger irregularly shaped spot between veins 1 and 2 immediately below the subquadrate spot last mentioned, and separated from it only by the black line of the median vein; beyond this spot, toward the anal angle, is a small subquadrate spot; toward the base on the lower margin of the

Fig. 2.

cell a small triangular spot; just below it another equally small or smaller spot; on the upperside of vein 1, not halfway from the base, a moderately large subtriangular spot; two smaller spots nearer the base on the upperside of vein 1; on the inner margin about the middle a large spot. The hind wings are dark lemon-yellow, broadly bordered with black. On the inner margin, which is densely clothed with long brownish hair, the black border is diffuse, while on the outer margin it is boldly and sharply defined on the inner edge. Between veins 2 and 4 the outer margin is somewhat strongly produced inwardly. The fringes of the secondaries on the upperside are black, except at the outer angle, where they are conspicuously white.

On the underside the markings are, in the main, as on the

upperside of the wings, but the yellow of the underside is deep orange-yellow and the fringes of the secondaries on the underside are white throughout.

Expanse 96 millim.

Type in the Royal Natural History Museum in Berlin.

These two species of *Xanthospilopteryx* are the largest of the genus thus far discovered in Africa, and belong to the same group with the splendid insect named *X. Hornimanni*, Druce.

Hotel Victoria, London,
July 14, 1897.

XXVIII.—*On a Collection of Fishes from the Island of Marajo, Brazil.* By G. A. Boulenger, F.R.S.

A large and important collection of Fishes formed on the island of Marajo has been sent to me for identification by Dr. E. A. Goeldi, the Director of the Pará Museum, with permission to retain types and duplicates for the British Museum. It seems to me desirable to publish a list of all the Fishes identified, together with the descriptions of two which require the establishment of new species. One of the most valuable examples in the collection is the *Lepidosiren* previously recorded by Dr. Goeldi, and which, I am glad to add, I have been allowed to incorporate in the British Museum collection.

TELEOSTEI.

Serranidæ.

1. *Epinephelus itaiara*, Licht. M.*
2. *Centropomus undecimalis*, Lacép. M.

Pristipomatidæ.

3. *Diagramma Goeldii*, sp. n. M.

Depth of body $2\frac{1}{2}$ times in total length, length of head $3\frac{1}{3}$. Snout as long as diameter of eye, which is 4 times in length of head; interorbital region nearly flat, its width nearly $\frac{1}{3}$ length of head; maxillary extending to below anterior

* These initials refer to the localities, and read thus:—
M. Magoarisinho, Cape Magoary.
P. Pocoval, Cape Magoary.
S. Soure.

border of eye; præopercular border distinctly serrated; snout naked, rest of head scaly. Gill-rakers moderate, the longest measuring about $\frac{1}{3}$ diameter of eye, 12 on lower part of anterior arch. Dorsal XIII 12, originating above posterior border of opercle, the spinous portion $2\frac{1}{2}$ times as long as the soft and twice as deep; spines strong, increasing in length to the fifth, which measures a little over half length of head, and decreasing again to the last two, which measure $\frac{1}{4}$ length of head. Pectoral $\frac{3}{4}$ length of head, as long as ventral. Anal III 11; second spine very strong, longest, $\frac{2}{3}$ length of head. Caudal with crescentic emargination. Scales finely ciliated, 65 $\frac{7}{20}$; lat. l. 57. Uniform silvery.

Total length 260 millim.

Sciænidæ.

4. *Sciæna amazonica*, Cast. M., S.
5. *Plagioscion squamosissimus*, Heck. M.
6. *Plagioscion auratus*, Cast. M.
7. *Otolithus liarchus*, C. & V. M.

Carangidæ.

8. *Argyriosus vomer*, L. S.

Batrachidæ.

9. *Batrachus surinamensis*, Bl. Schn. M.

Mugilidæ.

10. *Mugil incilis*, Hancock. M.

Cichlidæ.

11. *Acara tetramerus*, Heck.
12. *Heros coryphænoides*, Heck.
13. *Hygrogonus ocellatus*, Ag. S.
14. *Cichla temensis*, Humb.
15. *Crenicichla johanna*, Heck.
16. *Crenicichla saxatilis*, L. S.
17. *Chætobranchus robustus*, Gthr. S.
18. *Satanoperca jurupari*, Heck.

Pleuronectidæ.

19. *Solea maculipinnis*, Ag. M.

Siluridæ.

20. *Pimelodus maculatus*, Lacép.
21. *Pimelodus ornatus*, Kner.
22. *Pimelodus Muelleri*, Gthr. P.
23. *Pimelodus altipinnis*, Stdr. M.
24. *Platystoma Vaillanti*, C. & V. M.
25. *Piratinga Rousseauxii*, Cast. P.
26. *Arius Herzbergii*, Bl. M., P., S.
27. *Arius proops*, C. & V. M.
28. *Arius luniscutis*, C. & V. M.
29. *Arius rugispinis*, C. & V. M., P., S.
30. *Arius nuchalis*, Gthr. M.

31. *Arius pleurops*, sp. n. M.

Palatine teeth villiform, in two widely separated transverse patches which are narrower than the præmaxillary band. Depth of body $4\frac{2}{3}$ times in total length, length of head $3\frac{1}{4}$. Width of head $\frac{2}{3}$ its length; upper surface granular posteriorly; fontanelle extending from the internarial region to the base of the occipital process, which is keeled, nearly as long as broad, and in contact with a very small crescentic bone at the base of the dorsal; naked parts of head with reticulating or arborescent canals; eye perfectly lateral, just behind and on a level with the angle of the mouth, its diameter 5 times in length of head, $1\frac{1}{2}$ in length of snout, $2\frac{1}{2}$ in interorbital width; barbels short, not reaching gill-clett. Dorsal I 6; spine nearly $\frac{2}{3}$ length of head, granular in front, with antrorse serration behind. Adipose fin small, its base $\frac{1}{2}$ that of dorsal. Pectoral spine slightly shorter than dorsal, likewise granular in front and serrated behind. Anal 20, its longest rays $\frac{2}{5}$ length of head. Caudal deeply forked. Brown above, silvery beneath.

Total length 170 millim.

The single specimen sheltered in its mouth eighteen eggs, 8 millim. in diameter, with embryos in an advanced state of development.

32. *Ælurichthys Gronovii*, C. & V. M.
33. *Auchenipterus striatulus*, Stdr.

34. *Auchenipterus nodosus*, Bl. M.

Differs from the typical form in having the dorsal and

pectoral spines shorter than the head, the body less elongate, the length of the head barely four times in the total, and the supraoccipital bone broader than long. Dr. and Mrs. Eigenmann have already drawn attention to the great variation in the length of the spines in this species, and observed them to be shorter in specimens from Pará.

35. *Cetopsis cœcutiens*, Licht.

36. *Doras costatus*, L. S.

The single specimen, 220 millim. long, has a very puzzling appearance, owing to the absence of the caudal peduncle. The posterior end of the tail must have been accidentally amputated, and the shape of the well-developed caudal fin points to neogenesis. The posterior scutes being missing, with the caudal peduncle, the lateral line numbers only 23.

37. *Doras Weddelli*, Cast.
38. *Doras dorsalis*, C. & V.
39. *Callichthys littoralis*, Hancock. P.
40. *Plecostomus bicirrhosus*, Gron. M., P.
41. *Liposarcus pardalis*, Cast. S.
42. *Chætostomus spinosus*, Cast.
43. *Chætostomus cirrhosus*, Val.
44. *Aspredo cotylophorus*, Bl. M., P.

Characinidæ.

45. *Macrodon trahira*, Bl. Schn. P.
46. *Macrodon intermedius*, Gthr. P.
47. *Erythrinus unitæniatus*, Spix. P., S.
48. *Hemiodus microcephalus*, Gthr.
49. *Anostomus fasciatus*, Ag. S.
50. *Leporinus affinis*, Gthr.
51. *Tetragonopterus maculatus*, L.
52. *Brycon brevicauda*, Gthr.
53. *Piabuca argentina*, L.
54. *Anacyrtus Myersii*, Gill.
55. *Serrasalmo serrulatus*, C. & V. S.
56. *Serrasalmo piraya*, Cuv. P.

57. *Myletes rubripinnis*, M. & T.
58. *Myletes maculatus*, Kner. S.

Scombresocidæ.

59. *Belone tæniata*, Gthr. S.

Cyprinodontidæ.

60. *Anableps microlepis*, M. & T. P.

Clupeidæ.

61. *Pellona flavipinnis*, Val. M.
62. *Megalops thrissoides*, Bl. Schn. M.

Gymnotidæ.

63. *Carapus fasciatus*, Pall. S.

Tetrodontidæ.

64. *Tetrodon psittacus*, Bl. Schn. M.

DIPNOI.

65. *Lepidosiren paradoxa*, Fitz. M.

The discovery of this fish at Cape Magoary has been reported upon by Dr. Goeldi (Bol. Mus. Para. i. 1896, p. 438), who has also given a map showing the distribution of the species.

CHONDROPTERYGII.

66. *Carcharias porosus*, Poey. M.
67. *Trygon tuberculata*, Lacép. M.
68. *Trygon hystrix*, M. & H.

The description is appended of a new Chromid obtained by Dr. Goeldi in the Upper Cunani River, French Guiana, south of the Oyapok River.

Heros Goeldii, sp. n.

Depth of body 2 in total length, length of head 3 times. Upper profile of head regularly curved; eye nearer gill-opening than end of snout, its diameter $3\frac{1}{2}$ to $3\frac{2}{3}$ times in length of head and $\frac{2}{3}$ interorbital width; cleft of mouth not

extending to below anterior border of eye; scales on cheek in 4 series. Dorsal XVI 12, originating above opercular cleft; spines gradually increasing in length to the last, which measures $\frac{1}{3}$ length of head; soft dorsal pointed, middle rays longest, produced, nearly as long as head. Pectoral a little shorter than head. Ventral with produced inner ray, reaching middle of anal. Anal VI 9; spines and soft rays as in the dorsal. Caudal rounded. Scales 31 $\frac{4}{11}$; lat. l. $\frac{19}{11}$. Reddish brown, with a large black blotch on each side between the two lateral lines, below the middle of the dorsal fin.

Total length 160 millim.

Two specimens.

XXIX.—*Descriptions of some new Species of Heterocera from Tropical America.* By Herbert Druce, F.L.S. &c.

Fam. Agaristidæ.

Orthia volupia, sp. n.

Male.—Primaries black, crossed beyond the middle by a narrow cream-coloured band, which does not reach either margin: secondaries chrome-yellow, bordered with black, widest near the anal angle, the inner margin clothed with black hairs. Underside very similar to the upperside, but the band crossing the primaries wider and with a yellow streak extending from the base to the end of the cell. The head, antennæ, legs, and thorax black; the abdomen yellow, with a central black line extending from the base to the anus; the anus and anal segments on the underside black.

Expanse $2\frac{1}{4}$ inches.

Hab. Ecuador, St. Lusia (*Mus. Druce*).

This species is allied to *O. præfectus*, Druce, which has the primaries entirely black.

Orthia elaphebolia, sp. n.

Male.—Primaries deep black, crossed beyond the middle by a narrow chrome-yellow band that does not reach either margin, the fringe black: secondaries deep black, with a large central lobe-shaped yellow spot extending from the base. The head, antennæ, thorax, upper and underside of the abdomen, and the legs black; the collar and sides of the abdomen chrome-yellow, the anus black.

Expanse $2\frac{1}{2}$ inches.

Hab. Ecuador, Intaj (*Buckley, Mus. Druce*).

This species is allied to *O. ecuadorina*, Westwood, from which it is at once distinguished by the entirely different shape of the yellow marking on the secondaries, the yellow collar, and yellow sides to the abdomen.

Phasis mardava, sp. n.

Primaries deep black, crossed about the middle by a curved cream-coloured band, which extends from the costal margin to the apex: secondaries dark brown. The head, antennæ, thorax, abdomen, and legs black.

Expanse 2 inches.

Hab. East Peru (*Mus. Druce*).

Leiosoma buprasium, sp. n.

Male.—Primaries deep reddish brown, palest near the apex, where the wing is thickly irrorated with greyish-white scales; a narrow brown line crosses the wing from the costal margin to the anal angle; a marginal row of very minute white dots extends from the apex to the anal angle: secondaries pale chrome-yellow, very broadly bordered with deep black. The head, antennæ, abdomen, and legs black; the thorax reddish brown; anus yellow.

Expanse $1\frac{3}{4}$ inch.

Hab. Ecuador, Sarayacu (*Buckley, Mus. Druce*).

Euthisanotia lycaon, sp. n.

Male.—Primaries dark reddish brown, with three white marks along the costal margin—the first V-shaped, close to the base, the second a wide U-shaped mark, and the third a large almost square-shaped mark nearest the apex: secondaries pale chrome-yellow, broadly bordered from the apex to the anal angle with dark reddish brown. Underside very similar to the upperside, but with more white on the primaries. The head, collar, and tegulæ white; thorax reddish brown; abdomen yellow, banded with black on the upperside; antennæ black; legs yellow.

Expanse $1\frac{3}{4}$ inch.

Hab. Ecuador, Sarayacu (*Buckley, Mus. Druce*).

This species is very distinct.

Fam. **Zygænidæ.**

Calanotos (?) *nana*, sp. n.

Male.—Primaries dull black, with a small white spot on

the costal margin close to the base, below which is a metallic green spot; a rather large oval-shaped hyaline spot about the middle of the wing, beyond which nearer the apex are three hyaline white spots almost in a straight line extending from the costal margin to the anal angle: secondaries dull black. Underside similar to the upperside. The head, antennæ, thorax, and legs black; two spots in front of the head and the collar white; abdomen black, streaked down the middle and on the sides with metallic green; the underside of the abdomen with a central white band, which extends from the base to the anus.—*Female* very similar to the male, but with only two white spots on the primaries near the apex and a white spot on the costal margin of the secondaries nearest the apex.

Expanse, ♂ 2, ♀ $1\frac{3}{4}$ inches.

Hab. Colombia, S. Martin, Lanos of Rio Meta (*Child*, *Mus. Druce*).

Calanotos (?) *argante*, sp. n.

Male.—Primaries deep black, the costal margin and a streak at the base of the wing bright metallic green; an elongated semihyaline white spot beyond the green streak, and nearer the apex a square-shaped semihyaline white spot: secondaries deep black, with the inner margin broadly bordered with pale fawn-colour. Underside very similar to the upperside, but the costal margin of the secondaries broadly bordered with metallic green. The head, antennæ, and legs black; collar spotted with white; tegulæ black; thorax and abdomen pale metallic green; abdomen striped with black from the middle to the anus.—*Female* very similar to the male, but has three white semihyaline spots on the primaries and one on the secondaries, the latter being entirely black.

Expanse, ♂ $1\frac{3}{4}$, ♀ $1\frac{1}{2}$ inch.

Hab. Ecuador, Sarayacu (*Buckley*, *Mus. Druce*).

Saurita vitristriga, sp. n.

Male.—Primaries and secondaries dull smoky black, with a semihyaline dusky streak at the base of both wings. The head, antennæ, thorax, abdomen, and legs black; abdomen with one central and two other greenish-grey streaks extending from the base to the anus.

Expanse $1\frac{3}{4}$ inch.

Hab. British Guiana, Essequibo River (*Whitely*, *Mus. Druce*).

Homœocera pelor, sp. n.

Male.—Primaries and secondaries yellowish hyaline; primaries, a small blue spot at the base, the apex and outer margin narrowly edged with black; the veins of both wings yellow. The head, antennæ, thorax, and abdomen black; the four basal segments of the abdomen edged with yellow; legs black, banded with yellow.

Expanse $1\frac{1}{2}$ inch.

Hab. Ecuador, Sarayacu (*Buckley*, *Mus. Druce*).

Homœocera tarapotensis, sp. n.

Male.—Primaries and secondaries hyaline, with the veins black; the base of the primaries and the inner margin yellow, the apex and outer margin black: secondaries with the outer margin black. The head and collar yellow, the collar spotted with black; the antennæ and tegulæ black, the tegulæ edged with yellow; thorax black, the base yellow; abdomen yellow, banded with black, and with two blue spots on each segment; the legs yellow.

Expanse $1\frac{1}{2}$ inch.

Hab. Peru, Tarapoto (*Mus. Druce*).

Gymnelia dexamene, sp. n.

Female.—Primaries hyaline, the veins all black, the outer margin from the apex to the anal angle broadly bordered with black: secondaries hyaline, bordered with black. The head, antennæ, collar, thorax, and abdomen black, the collar with two blue spots in front; tegulæ black; a large yellowish-white spot on both sides of the abdomen close to the base; a row of bluish-green spots on each side of the abdomen and a central bluish-green spot on the last three segments of the abdomen. On the underside there are three white spots on the first three segments.

Expanse $1\frac{7}{10}$ inch.

Hab. Brazil (*Mus. Druce*).

Gymnelia cuma, sp. n.

Male.—Primaries and secondaries hyaline, with the veins, outer and inner margins black; the base of the primaries and a narrow line partly crossing the wing black. The head, antennæ, thorax, and upperside of the abdomen deep black; four white spots at the base of the abdomen, the underside of the abdomen bright carmine; legs black.

Expanse $1\frac{3}{4}$ inch.

Hab. Columbia, S. Martin, Lanos of Rio Meta (*Child, Mus. Druce*).

Læmocharis clusia, sp. n.

Male.—Primaries brown, crossed beyond the middle by a wide creamy-white band; the veins all black, the fringe dark brown: secondaries dusky hyaline black. The head, antennæ, thorax, abdomen, and legs black; the tegulæ and a spot at the base of the abdomen bright carmine.

Expanse 1¼ inch.

Hab. Amazons, Maranham (*Leech, Mus. Druce*).

Cosmosoma voltumna, sp. n.

Male.—Primaries hyaline, the base, costal margin, and inner margin bright orange, the apex and outer margin black: secondaries hyaline, the apex, outer and inner margin black. Antennæ black; the head, thorax, and abdomen bright orange, the last two segments dark blue; the legs yellow.

Expanse 1¼ inch.

Hab. Amazons, Pará (*Mus. Druce*).

Dycladia (?) *pelopia*, sp. n.

Male.—Primaries and secondaries yellowish hyaline; primaries, the costal margin, the apex, and a small spot at the apex all black. The head and antennæ black; the front of the thorax black, the thorax and abdomen pale yellow; the anal segments of the abdomen black; the legs black and yellow.

Expanse 1 inch.

Hab. Panama, Chiriqui (*Mus. Druce*).

Eunomia nicippe, sp. n.

Male.—Primaries and secondaries hyaline, the veins all black; primaries crossed by two black bands, the first curved quite close to the base, the second at the end of the cell extending to the anal angle, where it is the widest, the apex black: secondaries with the outer margin from the apex to the anal angle black. The head, antennæ, and collar black, the collar spotted with blue; the thorax black; tegulæ cream-colour; the basal portion of the abdomen bright red, the other part black, spotted with white down the middle and along each side; legs black and white.

Expanse 1½ inch.

Hab. Peru (*Mus. Druce*).

This species is allied to *E. eone*, Hübn., but quite distinct.

Hæmaterion melanobasis, sp. n.

Male.—Primaries hyaline, the base, costal, outer, and inner margin black, the veins all black: secondaries whitish hyaline, broadly bordered with black; two small hyaline spots on the black border close to the apex. Underside the same as above. The head, antennæ, thorax, abdomen, and legs black; the first three segments of the abdomen with a central cream-coloured spot, the anal segments bright red.

Expanse $1\frac{3}{4}$ inch.

Hab. South Brazil (*Mus. Druce*).

Argyroeides placida, sp. n.

Male.—Primaries and secondaries yellowish hyaline; the fringe and veins of both wings black. The head, antennæ, thorax, abdomen, and legs black; the basal segment of the abdomen cream-colour; the abdomen banded with blue.

Expanse $1\frac{1}{4}$ inch.

Hab. Ecuador (*Mus. Druce*).

Fam. **Pericopidæ**.

Eucyane albimacula, sp. n.

Eucyane Arcei ♀, Druce, Biol. Centr.-Amer. ii. t. lxxvi. fig. 12, p. 383.

I had seen four females with the band crossing the primaries white, and concluded that they belonged to *E. Arcei*, as they differed in no other respect. Since then I have seen a white-banded male, which proves that they are referable to a distinct species and require to be named.

Eucyane cerealia, sp. n.

Male.—Primaries deep black: secondaries rich glossy deep blue, brightest near the base, the fringe carmine-red. The head, antennæ, legs, and thorax deep black; abdomen bright glossy blue.

Expanse $1\frac{3}{4}$ inch.

Hab. Ecuador (*Mus. Druce*).

This beautiful species is very distinct from all others known to me.

Eucyane lysimachides, sp. n.

Male.—Primaries deep black, crossed near the apex from the costal to the inner margin by a narrow carmine band, crossed by black veins: secondaries bright glossy deep blue,

with the outer margin from the apex to the anal angle broadly bordered with red-carmine. The underside very similar to the upperside. The head, palpi, and collar bright carmine; the tips of the palpi, antennæ, thorax, and legs black.

Expanse $1\frac{3}{4}$ inch.

Hab. Ecuador (*Mus. Druce*).

This species is allied to *E. phœnicides*, Druce, from Mexico, but is quite distinct.

Pericopis eugenia, sp. n.

Female.—Primaries very similar to those of *P. histrio*, but without the yellow band crossing the wing near the apex and with the black apical margin very much narrower; the marginal spots smaller and duller in colour: the secondaries very much the same as those of *P. histrio*, but darker in colour.

Expanse $3\frac{1}{4}$ inches.

Hab. East Peru (*Mus. Druce*).

XXX.—*Description of a new Gymnotine Fish of the Genus* Sternopygus. By G. A. Boulenger, F.R.S.

Sternopygus macrops.

Eye without free lid, a little longer than the snout or the interocular space. Mouth very narrow; maxillary shorter than the diameter of the eye; upper jaw overlapping the lower; upper profile of head descending in a curve. Vent a little behind vertical of posterior border of eye. Pectoral fin as long as head minus snout. Anal with 175 rays, originating below middle of pectoral. Depth of body greater than length of head, $7\frac{1}{2}$ times in length to end of anal. Tail produced beyond the anal in a very long appendage terminating filiform and measuring half total length without head. Scales very small. Uniform pale brownish; anal fin white.

Total length 230 millim.

This new species is easily distinguished from all others by its much larger eye. A single specimen, collected by Rose Lloyd in the higher Polaro River district, British Guiana, has been presented to the British Museum by Mr. J. J. Quelch.

XXXI.—*On the Reptiles of Rotuma Island, Polynesia.*

By G. A. Boulenger, F.R.S.

Mr. J. Stanley Gardiner has kindly entrusted to me the collection of Reptiles made by him on Rotuma, north of the Fiji Islands. Small as it is, the collection is of interest as affording information on an island the herpetological fauna of which had not been previously investigated, and in bringing to light a new species of Geckos, which I have much pleasure in naming in honour of its discoverer. Mr. Gardiner was assured by the natives that no other kinds of Lizards and Snakes exist on the island but those of which he secured specimens. Batrachians are absent.

The species are only eight in number, viz. seven Lizards and one Snake, and, with the exception of the new Gecko, are known to have a wide geographical distribution.

1. *Gehyra oceanica*, Less.

Known from the Moluccas, New Guinea, Admiralty Islands, Solomon Islands, Lord Howe Island, Fiji Islands, Tonga Islands, Samoa Islands, and Hervey Islands.

2. *Lepidodactylus lugubris*, D. & B.

Distributed from the Malay Peninsula and Archipelago to the Pelew Islands, New Guinea, Solomon Islands, New Hebrides, New Caledonia, Fiji Islands, and Tonga Islands.

3. *Lepidodactylus Gardineri*, sp. n.

Head small, oviform; snout once and one third the diameter of the orbit, which equals its distance from the ear-opening; forehead concave; ear-opening very small, oval, oblique. Body and limbs moderate. Digits moderate, inner well-developed; a very slight rudiment of web; 12 to 14 lamellæ under the median digits, 2 or 3 of the terminal ones divided. Scales uniformly granular, the granules larger on the snout, largest and flat on the belly. Rostral quadrangular, nearly twice as broad as deep, notched above mesially to receive an enlarged scale separating the nasals; nostril pierced between the rostral, the first labial, and three nasals; 11 upper and as many lower labials; each upper labial with a granular asperity or feebly raised vertical keel; three rows of very small chin-shields graduating into the granules on the throat. Tail cylindrical, tapering, covered with uniform small flat scales, which are larger on the lower

surface. Brown above, with indistinct darker bars across the body and tail; lower parts white, speckled with brown on the sides; throat greyish.

	millim.
Total length	80
Head	12
Width of head	7
Body	33
Fore limb	13
Hind limb	16
Tail (reproduced)	35

A single female specimen.

Nearest allied to *L. Guppyi*, Blgr., and *L. Woodfordii*, Blgr., from the Solomon Islands.

4. *Lygosoma noctua*, Less.

Known from New Guinea, Solomon Islands, Samoa Islands, Society Islands, Fiji Islands, Tonga Islands, and Sandwich Islands.

5. *Lygosoma cyanurum*, Less.

Found in Celebes, the Moluccas, New Guinea, and nearly all the small islands of the South Pacific, with the exception of New Caledonia.

6. *Lygosoma samoense*, A. Dum.

Inhabits the New Hebrides, Samoa Islands, Fiji Islands, and Tonga Islands.

7. *Lygosoma nigrum*, Hombr. & Jacq.

Inhabits the Caroline Islands, New Ireland, Solomon Islands, Banks's Island, Samoa Islands, Fiji Islands, and Tonga Islands.

8. *Enygrus australis*, Montrouzier.

This snake, which has long been confounded with *E. Bibronii*, Hombr. & Jacq., is known from New Britain, the Solomon Islands, the New Hebrides, Loyalty Islands, and Samoa Islands; whilst *E. Bibronii* is on record from San Christoval, and the Fiji and Tonga Islands.

The specimens, four in number, brought home by Mr. Gardiner, have 37 to 39 scales across the body, 235 to 240 ventrals, and 57 to 63 subcaudals.

XXXII.—*On two new Rodents from Van, Kurdistan.*

By Oldfield Thomas.

The British Museum owes to Major W. H. Williams, recently H.M. Consul at Van, Kurdistan, Eastern Asia Minor, a collection of small mammals made in the neighbourhood of that place. Besides many other specimens of interest to mammalogists, there are examples of the two following new species:—

Ellobius lutescens, sp. n.

Size medium. Fur long and loose, not so close or sleek as in the other species. General colour dull slaty buff, quite different from the bright yellowish of the Eastern species, with which it agrees in tooth-structure, and more similar to dark examples of *E. talpinus* from the Volga. Head but little darker than body. Belly scarcely lighter than back, the line of demarcation quite gradual. Everywhere, above and below, the hairs are dark slaty grey with buffy tips.

Skull with a long slender muzzle. Nasals long and very narrow, much compressed for their posterior two thirds. Zygomata boldly expanded, starting out anteriorly at a right angle to the general line of the skull. Lambdoid crest curving forwards mesially, not forming an angle in the middle line. Posterior palate much as in *E. fuscocapillus*, but inner part of bullæ rising much higher above the level of the basioccipital and basisphenoid than in that species.

Teeth apparently as in *E. fuscocapillus*, the complicated shape of the last upper molar quite as in that species*, and perfectly similar in all the six specimens obtained by Major Williams.

Dimensions of the type, an adult female, measured in flesh by collector:—

Head and body 125 millim.; tail 14; hind foot 22.

Skull: basal length 31; basilar length 28; greatest breadth 24; nasals $10 \times 3{\cdot}4$; palate, length from henselion 18·7; diastema 12; length of upper molar series 7·2.

Hab. Van, alt. 5000 feet.

Type. B.M. no. 97.6.4.17. Collected April 12, 1897.

This *Ellobius* is very distinct from any previously described. From the group containing *E. talpinus*, *Tancrei*, and *rufescens* (stated by Büchner to be all identical), it differs by the structure of its last upper molars, which are as in *E. fuscocapillus*. From the latter again, as from the

* Figured by Blanford, J. A. S. B. l. pt. 2, pl. ii. (1881).

closely allied *E. intermedius*, it may be distinguished by its smaller size, loose fur, and dull coloration.

Allactaga Williamsi, sp. n.

Intermediate in size between the large *A. alactaga*, Oliv.*, and the much smaller *A. euphratica*, *acontion*, and *indica*. General colour coarsely mixed yellowish buff and black. Face more finely grizzled buff; a spot above the eye posteriorly and a large patch on the cheek below the eye white. The latter patch is succeeded behind by the clear yellowish buff of the sides of the neck and upper part of the shoulder. Flanks bordering the white belly also more or less buffy, interrupted behind by the usual white hip-stripe. Below the latter the outer sides of the thighs and legs to the ankles are bright rich salmon-buff (almost orange-buff of Ridgway); upper surface of hands and feet white. Ears of medium length, their hairs rich buff, but as these are only present in any number along the anterior third of the outer surface and along the extreme edge of the inner surface, the rest of the ear appears dull brown (which may or may not be flesh-coloured in life). Tail for the greater part of its length bright buffy, whiter below. Distally, as the hairs lengthen they become blackish, at least above, and form a black subterminal band from one to two inches in length, succeeded by a pure white tip supported on the terminal half-inch of the tail-vertebræ.

Skull strong and stoutly built, forming a large edition of that of *A. acontion*, quite different from the long-muzzled skull of *A. mongolica*, Radde (incl. *A. annulata*, M.-Edw.). Upper premolar only about a quarter the size of m^3, which in its turn is about one-third the size of m^2.

Dimensions of the type, an adult male, taken by the collector in the flesh :—

Head and body 141 millim.; tail 203; hind foot 65; ear 46.

Skull: basilar length 27·2; greatest breadth 23·8; nasals

* *Dipus alactaga*, Oliv. Bull. Soc. Philom. ii. p. 121 (1800). The proper name of this species is somewhat doubtful. Büchner calls it *A. saliens*; but this is based on Gmelin's *Cuniculus pumilio saliens*, which was not given binomially at all, and has therefore no status in nomenclature. By Blanford and myself it has been called *A. decumana*, Licht., but the name used above has a priority of 25 years over that given by Lichtenstein. The words *major*, *media*, *minor*, *pygmæa*, and *minuta*, occurring *passim* in Pallas's account of his *Mus jaculus* (Glires, p. 275 *et seqq.*), are, in a book written throughout in Latin, apparently used as descriptive *words*, and are clearly not given as *names*, for which they cannot therefore be used.

13 × 4·8; interorbital breadth 9; breadth of brain-case 18; palate, length from henselion 18·3; diastema 10·5; palatal foramina 6·5 × 3 3; combined length of upper molars, excluding premolar, 5·7.

Hab. Van, alt. 5000 feet.

Type. B.M. no. 97.6.4.18. Collected May 28, 1896.

This beautifully-marked Jerboa, which I have named in honour of its collector and donor, Major Williams, is readily distinguished from all previously described species merely by its general proportions, as its hind feet, while far shorter than those of *A. alactaga*, considerably surpass those of the other species above mentioned. Probably it is really most nearly allied to *A. euphratica*, but its longer hind feet will readily distinguish it. In colour it is one of the most beautiful of the family, owing to the brightness and intensity of the buff stripe which runs down the hind legs.

In Satunin's admirable paper on Caucasian mammals * there are mentioned under *Alactaga acontion*, besides the normal N.-Caucasian form, examples from Transcaucasia which are stated to show "bedeutende Abweichungen" from the typical form. In all probability these examples belong to *A. Williamsi*.

XXXIII.—*On new Species of* Forficularia.

By Malcolm Burr, F.Z.S.

The following new species and varieties are, with one exception, described from specimens taken by Herr Frühstorfer in the Celebes, Java, and Lombok, and I have great pleasure in dedicating one species to this ardent collector. The collection also included two other species of *Spongophora* and one new *Chætospania*, which I have refrained from describing, as I possess only females, and those not in good condition.

The collection made by Herr Frühstorfer is of great interest as including species from several localities, which I hope to work out more fully at a later date.

I take this opportunity of thanking my learned colleague M. de Bormans, to whom I am indebted for his invaluable assistance in determining many of the species and fixing the novelties.

* Zool. Jahrb. ix. p. 308 (1896).

Anisolabis (?) *Kirbyi*, sp. n.

Fusca, nitida, glabra; capite pronoto paulo latiori; elytrorum alarumque rudimentis nullis; abdomine postice dilatato, tuberculis lateralibus nullis instructo, segmento ultimo magno, rotundato; pedibus fusco-testaceis; pygidio haud conspicuo; forcipis brachiis teretibus, basi distantibus, validis, triquetris, a latere visis leviter sinuatis, inermibus, brachio dextro magis incurvo quam altero. ♂.

	♂.
Long. corp.	11·5 mm.
,, fore.	2·75 ,,

Head rounded, frons fuscous, posterior part reddish; mouth-parts testaceous; antennæ wanting. *Pronotum* slightly narrower than the head; square, slightly longer than broad, reddish fuscous. *Mesonotum* darker, about twice as broad as long. *Metanotum* short, considerably broader than long, posterior margin sinuate, with the angles produced sharply posteriorly. *Pro-*, *meso-*, and *metasternum* testaceous. *Feet* dark testaceous; tarsi clothed with a few short stiff hairs. *Abdomen* dilated posteriorly, each segment being broader than the segment anterior to it. *Ultimate segment* large, round, posterior margin straight; there is a slight semicircular depression within the lateral margins, the margins slightly raised and crenulate. *Forceps* with the branches stout and distant at the base, the left branch gradually incurved, the right branch straight, then suddenly curved in at a right angle, shorter than the left, the apex being incurved within the apex of the left branch; as seen from the side the branches are slightly curved upwards. ♂.

Patria. Pengalengan, Western Java, 4000′ (*H. Frühstorfer*). Type in coll. m.

Allied to *A. javana*, Borm., from which it may be distinguished by the abdomen being more dilated posteriorly, and by the shape of the forceps: in *javana* both branches are equally incurved, the apices meeting; in *Kirbyi* the right branch is curved within the left, as in *Anisolabis maritima*, Bon.

For those *Anisolabes* with the appearance of *Chelidura*, i. e., *javana*, Borm., *lativentris*, Phil., and this species, with the abdomen dilated, a new genus is required, but I refrain from creating it now, as M. de Bormans informs me that they will form his new genus (inedit.).

I have great pleasure in dedicating this curious species to my friend Mr. W. F. Kirby, F.L.S., of the British Museum.

Labia dolicha, sp. n.

Inter maximas generis: nitida, fusca, pallido variegata, glabra; capite nigro, nitido, postice rubro; pronoto elytrisque nigris,

nitidis, testaceo-marginatis; alis nullis; abdomine minutissimo punctulato, fusco, rubro variegato; pedibus testaceis, fusco marmoreis; pygidium ♂ rotundatum, obtusum; forcipis crura ♂ depressa, elongata, sinuata, intus medio denticulata. ♂.

	♂.
Long. corp.	6·25–8 mm.
„ forc.	4–6·25 „

Head rounded, black, shining, reddish posteriorly; mouth-parts paler; antennæ 13-segmentate, segments 1, 2, and 12 pale, the rest fuscous. *Pronotum* shining, black; lateral margins testaceous, as broad as the head; posterior margin rounded. *Elytra* shining fuscous, exterior margins testaceous, about half as long again as the pronotum, truncated posteriorly. *Wings* absent. *Feet* testaceous, marbled with fuscous; tarsi testaceous, thickly clothed with fine pale hairs. *Abdomen* shining fuscous; last 4 segments, excepting the apical, reddish, all very finely punctulated above; no lateral tubercles; last dorsal segment fuscous, posterior margin sinuate. *Pygidium* is a short blunt tubercle, not reaching beyond the last ventral plate. *Forceps*, ♂, with the branches distant at the base, long and slender, slightly approximating in the first half, then diverging, incurved at the apex, where they meet, sometimes decussating; at the centre of the inner margin there are two sharp, small teeth, pointing posteriorly, the second one sometimes nearly obsolete. ♂.

Patria. Bua-Kraeng in the Southern Celebes, 5000′ (*H. Frühstorfer*). Type in coll. m.

This peculiar species has the appearance of an *Opisthocosmia*, but the cylindrical second joint of the tarsi at once separates it; the forceps somewhat resemble that of *Labia chelidurοides*, Borm., from Mexico. It can be at once recognized by the long and slender forceps. Perhaps a new genus might be created for those species of *Labia* with these long and peculiar forceps (*chelidurοides*, Borm., and *dolicha*, supra).

Labia Frühstorferi, sp. n.

Minor, nigra, pubescens; capite, pronoto, elytris, alis, femoribus, abdomineque (segmento ultimo excepto) nigris; antennis fusco-rubris, 12-segmentatis; tibiis tarsisque testaceis; segmento ultimo ♂ ♀ rubro, simplici, angusto; pygidio obtecto; forcipe rubro, cruribus ♂ basi distantibus, inermibus, rectis, apice attingentibus; ♀ contiguis per totam longitudinem, apice attingentibus, necnon decussatis. Variat. pronoto rubro. ♂ ♀.

	♂.	♀.
Long. corp.	5	4·5–5 mm.
„ forc.	2	1 „

Head flat, black; antennæ 12-segmentate, dark reddish, the joints conical. *Pronotum* narrower than the head, rounded posteriorly, black, anterior margin oblique on each side of the head. *Elytra* finely punctulated, black, nearly twice as long as the pronotum. *Wings* about ⅔ the length of the elytra, black, punctulated. *Feet*: femora fuscous; tibiæ and tarsi testaceous. *Abdomen* punctulated above, slightly narrower posteriorly, black, except the last segment; no lateral tubercles; last segment reddish, twice as broad as long, posterior margin straight. *Forceps* reddish, ♂ the branches distant at the base, stout, straight, incurved towards the apex, where they meet; ♀ branches contiguous for their whole length, parallel, sometimes decussating at the apex. ♂ ♀.

Patria. Sapit in Lombok, in April, 2000′ (*H. Frühstorfer*). Type in coll. m.

This little species is allied to *Labia minor*, L., and also, M. de Bormans tells me, to *Labia pilicornis*, Motsch., which I have never seen. It may be distinguished from *L. minor* by its darker colour and the absence of the spine on the pygidium of the male, which is a characteristic of the latter species.

Spongophora Bormansi, sp. n.

Magna, nitida, glabra; capite, pronoto, elytris, abdomineque fusconigris, alis sulphureis; antennis pedibusque testaceis, dense fuscomarmoreis; pygidium ♂ breve, latum, angulis acutis; forcipis crura ♂ basi distantia, gracilia, leviter sinuata, apice attingentia, margine interno minute serrulato per totam longitudinem. ♂ ♀.

	♂.	♀.
Long. corp.	21	14 mm.
„ forc.	10·5	5 „

Head black, shining, rounded; mouth-parts black; antennæ (?). *Pronotum* black, shining, as broad as the head, slightly broader than long, square, with rounded angles. *Elytra* black, shining, more than twice as long as the pronotum, considerably broader anteriorly than posteriorly, the anterior margin being rounded at the angles; obliquely truncated at the apex. *Wings* projecting far beyond the elytra, bright shining yellow. *Feet* testaceous, thickly marbled with fuscous. *Abdomen* black, shining, the sides parallel, rugulose on the dorsal surface; segments 3 and 4 with very faint lateral tubercles, the hinder margins of the segments serrulate. Ultimate dorsal segment large, square, shining black, smooth, serrulated on the posterior margin above; posterior margin straight, with a slight impression in the centre above the serrulations. *Pygidium* ♂ short, broad,

straight at the apex, produced to a point at each corner. *Pygidium* ♀ not visible. *Branches of forceps* ♂ dark reddish, distant at the base, as seen from above diverging very slightly, then gradually approximating, more suddenly about ⅔ the length from the base, then approaching regularly until they meet and cross at the apex; seen from the side the branches are almost horizontal, very slightly sinuate: on the inner margin the branches are very finely serrulated for their whole length; in the ♀ very slightly sinuate, crenulated on the inner margin, except at the base itself. ♂ ♀.

Patria. Santa Catharina (♂ in coll. m.), Bahia (♀ in coll. de Bormans). Type ♂ in coll. m.

It is with very great pleasure that I dedicate this fine species to my learned colleague M. de Bormans, who has done so much to increase our knowledge of these neglected insects. It is to him that I owe the description of the female, which he has very kindly sent me, taken from a specimen in his rich collection. It is allied to *Sp. croceipennis,* Serv., but differs in its bright, almost metallic appearance, the colour of the feet and the form of the pygidium and forceps.

Spongophora guttulata, sp. n.

Parva, nigra, glabra; capite, pronoto, abdomine, femoribus, et tibiarum parte basali fusco-nigris; antennis fusco-rufis, segmentis duobus primis exceptis pallidioribus; elytra fusca, flavo-maculata; alæ flavæ, apice margineque externo fuscæ. Pygidium inconspicuum, obtectum. Forcipis brachia gracilia, inermia: ♂ basi distantia, fere recta, apice approximata; ♀ basi fere contigua, recta, apice necnon decussata. ♂ ♀.

	♂.	♀.
Long. corp.	8	8–9·25 mm.
,, forc.	4	2·5 ,,

Head rounded, black, shining; mouth-parts black, palpi dark reddish; antennæ, of which 13 segments remain in one specimen, dark reddish, except the two basal segments, which are paler. *Pronotum* black, shining, as broad as long, as broad as the head, with the angles rounded. *Elytra* about twice as long as the pronotum, fuscous, with a large yellow spot at the shoulder. *Wings* projecting well beyond the elytra, yellow, narrowly bordered with fuscous exteriorly, the fuscous broadening at the apex. *Feet*: femora fuscous; tibiæ fuscous towards the base, testaceous towards the apex; tarsi testaceous. *Abdomen* fuscous, shining, smooth, lateral tubercle on fourth segment; last dorsal segment (♂) small, simple, posterior border straight, with a faint tubercle above the base of each branch of the forceps. *Forceps* dark reddish, shaded with fuscous: ♂ branches widely distant at the base, slender, nearly straight, incurved towards the apex, where

they nearly meet; on the inner margin close to the base is a very small tooth; ♀ branches nearly contiguous at the base, straight, meeting at the apex, sometimes decussating. ♂ ♀.

Patria. Lombok, Sapit, 2000′; Sambalun, 4000′; in April, May, and June: 1 ♂, 5 ♀ (*H. Frühstorfer*). Type in coll. m.

Chelisoches punctulatus, sp. n.

Niger, glaber; antennis segmentis 1° et 2° nigris, ceteris testaceis; capite, pronoto, elytris, abdomine, femoribus, tibiisque fuscis, tarsis testaceis; alis nullis; abdomine punctulatissimo; forcipis crura ♀ valida, basi contigua, apice decussata. ♀.

♀.

Long. corp.	13 mm.
„ forc.	3 „

Head rounded, black; antennæ, of which 11 segments remain, testaceous, except segments 1 and 2, which are black. *Pronotum* as broad as the head, slightly longer than broad; posterior angles rounded, colour dull black. *Elytra* dull black, scarcely longer than pronotum, truncated posteriorly. *Wings* absent. *Abdomen* very dark fuscous brown, very densely and finely punctulated; faint lateral tubercles on fourth segment; last dorsal segment (♀) small, smooth, with a faint median longitudinal suture. *Pygidium*, ♀, small, round, almost hidden. *Feet*: femora and tibiæ very dark brown; tarsi testaceous, clothed with fine pale hairs. *Forceps*, ♀, with branches stout, contiguous at the base, very minutely crenulated on the inner margin, crossing at the apex. ♀.

Patria. Lompa-Battau in Southern Celebes (3000′), in March (*H. Frühstorfer*). Type in coll. m.

It is usual to refrain from describing a single female, but this appears to be such a distinct species that I have ventured to do so here. It may be distinguished by the absence of wings, colour of the antennæ and of the feet, and the densely punctulated abdomen. The lobe on the second tarsal joint (characteristic of the genus) is not large and somewhat difficult to distinguish. I have examined the insect under the microscope, and there is no doubt that it is a veritable *Chelisoches*.

Chelisoches melanocephalus, Dohrn, var. nov.

A typo differt, elytris alisque brunneis, antennis segmentis 1°–4ᵐ testaceis.

Patria. Pengalengan, in Western Java, 4000′ (*H. Frühstorfer*). Type in coll. m.

This variety may prove to be a distinct species, but there seems to be no other points upon which to separate it other than the colour of the elytra and wings and certain segments of the antennæ, which is very variable in this group of insects.

Opisthocosmia forcipata, de Haan, var.

I have six females of a curious variety of this species, in which the head and pronotum, instead of being dark fuscous, are of a clear red. I can find no other points of distinction, and do not consider it of specific rank. These specimens all came from Sapit and Sambalun in Lombok ; I have specimens of the type form from Southern Celebes and not from Lombok, but have no specimens of this variety from other localities.

O. forcipata is taken in Sumatra.

Bellagio, East Grinstead.
July 25, 1897.

XXXIV.—*On a Collection of small Mammals from Uganda.*

By W. E. de Winton.

Mr. Oldfield Thomas has entrusted me with the working out of some small mammals collected at Ntebe or Entebbi in Uganda, on the north-western shore of the Victoria Nyanza, by Mr. F. J. Jackson, to whom we are already so much indebted for our knowledge of the several faunas of East Africa. This collection was made about two years ago, but seems to have been mislaid and overlooked by the collector; some of the specimens consequently have been badly damaged by beetles, but the majority are in excellent preservation, and among them are found two species of mice hitherto undescribed.

While working out this collection a specimen of *Arvicanthis* which has long been in the British Museum is found to require a name, and this opportunity is taken of publishing the description, as the locality from which it was obtained is not very far distant.

The bats, with one exception, belong to species to be expected from this district, but, so far, very little collecting has been done on the western side of the lake, so that every specimen is of great interest, no account of the small mammals found there having yet been published.

1. *Rhinolophus Hildebrandti*, Peters.

Four specimens.

2. *Hipposiderus caffer* (Sundev.).

Five specimens in various colours as usual, with which age, sex, or season seem to have no connexion.

3. *Vesperugo tenuipinnis* (Peters).

Two specimens.

4. *Chalinolobus variegatus* (Tomes).

One. Without having seen the type of this species, which is in the Berlin Museum, the identification of this specimen must be somewhat uncertain; but, if correctly determined, it is of great interest, as this pretty butterfly-bat has hitherto only been obtained in S.W. Africa (Otjoro, Damaraland). At the same time there is no reason why the two should not be identical. No. 2 in this list is a good example of an even more extended range and preservation of all its peculiar colour-varieties throughout.

5. *Scotophilus nigrita* (Schreb.).

One.

6. *Crocidura*, sp.

Ad. male and juv. Appears to be closely allied to *C. Martensii*, Dobs., from the Cape.

7. *Sciurus Boehmi*, Reichen.

Male and female. The loss of one or more vertebræ of the tail seems to be very common among the small squirrels of E. Africa, but the total length does not seem to suffer, as the hairs grow in proportion; in one of these specimens the hairs at the end of the tail (there appear to be three or four vertebræ missing) is 65 millim. in length.

8. *Mus ugandæ*, sp. n.

Size rather larger than *M. sylvaticus*. The whole of the upper parts finely grizzled slate-black, there being very little fawn tinge intermixed; this latter colour is more distinct on the sides of the neck. The sides, and especially the thighs, are rather more grey. The whole of the underparts are clear pale fawn, including the lower cheeks and upper lips. The hands and feet pale fawn. Underfur of all parts dark slate. Ears and tail naked, dark blackish brown. The colouring of the upper parts of this mouse is not very unlike the darkest plumbeous pelage of the immature *Mus sylvaticus*, but still darker. The tail is not very attenuated, being of about the same proportion as that of *M. musculus*. The feet are large and broad.

Measurements of type, ♂, Ntebe, 4. 6. 95 (*F. J. J.*):— Head and body 102 millim.; tail 90; hind foot 25·5; ear 18.

There are five specimens of this mouse in the collection.

Skull: greatest length 27·5 millim.; greatest breadth 13; breadth of brain-case 12·1; interorb. constr. 4; nasals 10·2 × 3·5; interparietal 3·3 × 8·5; basal length 24·2; henselion to back of palate 12; palatal foramina 6·5 × 2; molar series 5; outside $\frac{\text{ms. 1}}{}$ 6, inside 3; diastema 7·3; mandible-bone only, greatest length 15, height 7·5.

Colour of incisors orange above, honey-coloured below.

The type is a somewhat young specimen, the skulls of older individuals reaching about 2 millim. more in total length.

The nearest ally of this mouse is *Mus erythroleucus*, from West Africa; though outwardly differing in colour, the skull shows close affinities.

There is one female in the collection, but unfortunately the mammæ are not traceable; but, judging from the strong likeness in the skulls, there is little doubt that, like its ally, this new mouse is of the multimammate group. It will bear the name of the country in which it is found.

9. *Mus Jacksoni*, sp. n.

Pelage composed solely of soft fur; the whole of the upper parts smoky brown, showing a little more golden on the cheeks and sides; underparts grey. All the hairs of the body are slate-coloured for the greater part of their length, only the extreme tips being coloured, those above with brown and those beneath with white. Ears dark, naked, and very long. Tail much longer than the head and body, thin, naked, and unicoloured brown. Feet and hands very long, greyish.

Measurements, taken from dried skin: type, ♂, Entebbi (Ntebe), 10. 2. 95:—Head and body 78 millim.; tail 118; hind foot 22; ear 14.

Skull (base broken): point of nasals to lambda 22 millim.; greatest breadth 11·5, of brain-case 11; nasals 9; basal length 22; henselion to back of palate 11·5; palatal foramina 6×2; outside $\frac{\text{ms. } 1}{\phantom{\text{ms. } 1}}$ 6, inside $\frac{\text{ms. } 1}{\phantom{\text{ms. } 1}}$ 3; molar series 4·6; diastema 7.

Molars large, all well developed, last two together fully as long as first.

The length of the ears, tail, and hind feet at once distinguishes this species from all its congeners; it is, indeed, both in colour and shape, strikingly like a diminutive *Malacomys longipes*, and I know no true *Mus* to which it is at all nearly allied. I name it in honour of the collector.

It is highly probable that this mouse may prove to be identical with Dr. Noack's *Mystromys longicaudatus* (Zool. Jahrb. ii. p. 246, 1887), which belongs undoubtedly to the genus *Mus*, as is shown by the figures given of its skull and teeth. This being the case, the specific name need not be considered, as it is already occupied.

10. *Arvicanthis Spekei*, sp. n.

In coloration and general pattern of the markings re-

sembling *A. barbarus*, L., but blacker in tone and the stripes narrower. Central dorsal stripe black-brown; the region on either side, extending over two dark and two light stripes, strongly washed with brown; outside of this space the dark stripes are black, with a few light-coloured hairs intermixed, the light stripes buff-white, every second one being rather more conspicuous; the stripes get rather more broken nearing the belly. All the underparts buff-white. The ears are well clothed with brown hairs, but do not show nearly so much rufous as those of *A. barbarus*; the tail, which is also well covered with hair, is black along the middle line, inclining to rufous on the sides and buff-white beneath. Feet buff-white, claws brown.

Type 63. 7. 7. 23 in the British Museum; collected by Capt. Speke in Unyamuezi.

Measurements taken from skin:—Head and body 120 millim.; tail (end broken); hind foot 23·5; ear 13.

Skull: greatest length 29; breadth across zygomata 14, across brain-case 12·5; nasals 11 × 3·5; interparietal 3 × 8; basal length 25; henselion to back of palate 12·7; palatal foramina 5·1 × 2; upper molar series 5·3; outside $\frac{\text{ms. 1}}{\quad}$ 6·5, inside $\frac{\text{ms. 1}}{\quad}$ 3.

Incisors broad, orange above, rather paler below. Mandible (bone only), length 15·5, height at coronoid 9.

Compared with a mouse from Wadelai, which I take to be *A. zebra*, Heugl., the present species is larger, the stripes narrower and not so clearly defined; the size is intermediate between the Wadelai animal and *A. barbarus*, and therefore about equal to *A. pulchella*. The skull, compared with that of the last-named species, differs as follows:—narrower more pointed nasals, narrower interorbitally, profile more arched, smaller palatal foramina, molars rather more drawn out, incisors broader, the mandible has a deeper notch behind between the angle and the longer and more horizontal condyle.

The type and only specimen known is the animal mentioned by Gray (P. Z. S. 1864, p. 57) and by Sclater (id. p. 100) as being obtained by Capt. Speke, after whom I name the species.

The type of *Golunda pulchella*, which is still in the British Museum, is the common West-African species with spots, and not stripes; the plate (*t. c.* xiii.), stated to be taken from a West-African animal, is not in the least like that species, but is much more like the animal here described.

11. *Arvicanthis pulchellus*, Gray.

One. This specimen may be referred to Dr. Pagenstecher's

A. barbarus, var. *massaicus*; it has nothing to do with *A. barbarus*, but is very closely related to *A. pulchellus*.

12. *Arvicanthis abyssinicus*, Rüpp.

Six specimens of various ages.

13. *Leggada minutoides*, Sm.

One. This name is used for the smaller chestnut-brown form.

14. *Leggada musculoides*, Temm.

One. This name is used for the larger grey-brown form.

The two forms seem to be found side by side in various parts of Africa; but we must wait for more evidence before positively stating their relationship or otherwise.

XXXV.—*On a Collection of Rodents from Angola.*

By W. E. de Winton.

Through the kindness of Prof. Barboza du Bocage, of the Lisbon Museum, I have been entrusted with the working out of a number of rodents from Angola to be ultimately presented to the British Museum. My primary object was to endeavour to explain the various forms of *Georychus* found in this region, our Museum being very well supplied with forms from other parts of Africa. The results of my work are given below, and it will be seen that the *Georychi* were not the only animals of interest in the collection, a dormouse and a mouse being described as new.

Graphiurus angolensis, sp. n.

General colour drab-brown mixed with whitish, most of the underfur appearing to be tipped with the latter colour. All the underparts creamy white. Bases of all the body-fur above and below slate-black. Upper lips, cheeks, throat, hands, and feet entirely cream-white. Ears sparingly clothed with short brown hairs. Tail drab-brown, flecked with white, most of the hairs being tipped with white; these pale tips increase in length towards the distal portion, till at the extreme end the hairs may be entirely of the pale colour, forming a cream-white tag. The tail is bushy and flattened beneath; the hairs increase in length, graduating from the body to the tip.

Mammæ 2—2=8, 1 axillary, 1 behind the elbow, 1 on the extreme front of groin, 1 on groin.

Type ♀ in al. 92. 1. 9. 9 British Museum.

Loc. Caconda, Angola.

Measurements:—Head and body 96 millim.; tail 74; hind foot 18·4; ear 14; end hairs of tail 20.

In a male specimen the head and body measure 103, tail 84.

Skull: greatest length 30 millim.; greatest breadth 16·5; breadth of brain-case 14; constriction 4·6; nasals 11·7 × 4; interparietal bone 4 × 9·9; height above auditory bullæ 12; height at front of palate 5·1; basal length 26; henselion to back of palate 9·3; back of palate to foramen mag. 14; palatal foramina 3·5 × 2·6; diastema 6·6; molar series 3·6; outside $^{ms.1}$ 6·2, inside 4. Mandible (bone only), length 15·2, height at coronoid 8·3.

The most noticeable character in the skull which distinguishes this animal from its ally *G. murinus* is its greater height and more rounded shape; the skull is deeper in proportion, through the brain-case and auditory bullæ, than any *Graphiurus* yet described; the teeth also differ in pattern.

I have selected a specimen received from the Lisbon Museum on a former occasion as the type of this species. The present collection contains two specimens from Galanga; one of these is very interesting, its tail being in the peculiar state which led Dr. Jentink into proposing the genus *Claviglis*. This disease seems to be rather common in the African dormice. The bones of the tail coalesce distally and waste away, the tail gradually getting shorter; about six or more vertebræ are affected at the same time, forming a single bone tapering to a point, the muscles also wasting away. One specimen in the Museum has only a length of 5 millim. of healthy tail left at the base; in another the tail is normal for about 20 millim. The skin thickens in converse proportion to the wasting of the bone, so that the tail becomes club-shaped; and the shorter the tail becomes the broader is the end of the club. The disease does not affect the growth of the hair, for in one specimen the hairs are 27 millim. in length. The animals seem well nourished and otherwise healthy.

Otomys Anchietæ, Bocage.

One adult female, Caconda.

Very long clitoris. Four very small inguinal mammæ. Shows very slight iridescent purple and green colours when wet.

Mus, sp.

Two mice in the collection from Caconda belong to the multimammate group.

Mus Thomasi, sp. n.

All the upper parts uniform grizzled rufous brown; all the

underside greyish white, the bases of the hairs above and below slate-black. Ears almost round, sparsely covered with short reddish-brown hairs. Tail unicoloured brown, practically naked, though evenly covered with short stiff hairs. Scales in rings 10 to 9 millim. Feet very short and stout. Hind feet with only 5 pads, 1 and 2 well developed, 3, 4, and 5 small, hardly more than 1 millim. in length.

Loc. Galanga.

Measurements of type, ♂ in al., B.M. no. 97. 8. 6. 14:—Head and body 155 millim.; tail 120; hind foot 26; ear 19·5 × 17.

Skull: greatest length 36 millim.; greatest breadth 18; brain-case 15; constriction 5·5; nasals 14·5 × 4·5; interparietal bone 4·6 × 9; basal length 32; henselion to back of palate 17; back of palate to foramen magnum 12·5; palatal foramina 9·6 × 2·5; diastema 10·3; molar series 6·5; outside $\frac{\text{ms. 1}}{}$ 7·5, inside 3·6. Mandible length (bone only) 20, height at coronoid 10·7.

This is a peculiarly *Dasymys*-like rat in shape and texture of fur; in colour it closely resembles *Dasymys Bentleyæ*. The skull is also somewhat *Dasymys*-like, having rather strong zygomata, broad teeth, and long narrow palatal foramina; the latter are peculiar, reaching to fully the middle of the first molar, so that their length very nearly equals that of the diastema. When damp the fur shows iridescent colours of dark green, but not nearly so bright as in the next species.

The specific name is given in honour of the head of the Mammal Department of the British Museum, to perpetuate his connexion with this genus.

Dasymys nudipes, Peters.

One male, Caconda; one male, Hanha.

This animal shows very beautiful dark iridescent green colours when wet.

Golunda fallax, Peters.

Male and female, Hanha.

Shows no iridescent colours when wet.

Saccostomus mashonæ, de Winton.

Saccostomus mashonæ, de Winton, P. Z. S. 1896, p. 804.

Male and female, Caconda.

Although these specimens differ in colour (being uniform drab) from those from the typical locality, I can find no differences in the skulls, and we do not know sufficiently about seasonal changes to separate these mammals on colour alone.

Georychus Mechowi, Peters.

Georychus Mechowi, Peters, Jorn. Sci. Lisb. 1890, p. 271.

One female, Galanga.

It is much to be regretted that the skull of this fine specimen is badly broken, as it is the largest *Georychus* skull yet received in the British Museum, exceeding that of the one figured by Prof. Bocage.

Georychus Bocagei, sp. n.

Colour pale grey-drab, almost silver-grey; a deep purple stain at the corners of the mouth (no doubt due to the nature of its food). Head very large, measuring about one third of the total length. No white occipital spot (?).

Type ♂ (aged) in al., B.M. no. 97. 8. 6. 22.

Hanha, Angola.

Head and body 150 millim.; tail 15; hind foot 25.

Skull: greatest length 39 millim.; greatest breadth 30; temporal constriction 9; brain-case 15·5; nasals 15 × 3·5; basal length 35; henselion to back of palate 23; diastema 13·2; molar series 6; outside $\frac{\text{ms. 1}}{}$ 7. Mandible, greatest length of bone 30·5, height at coronoid 17.

The skull is broader and stronger than that of *G. hottentottus*, but the zygomata are not bowed out in the anterior portion so much as in that species or *G. damarensis*, but, like the latter, the inner face of the arch is turned upwards. The infraorbital foramina are long and narrow, broadest in the lower portion, the outer wall thin or moderate. Intermaxillary processes extending on the forehead rather beyond the nasals, the latter narrowing posteriorly and ending in a point in the middle line. The tooth-row appears to be somewhat shorter than in *G. hottentottus*; the palate ends posteriorly in a projecting point in the middle line.

I name this species in honour of the distinguished naturalist who has done so much in advancing our knowledge of the fauna of Angola. There are in the present collection ten specimens from various localities.

In working out the Angolan *Georychi* I fully appreciate the difficulties mentioned by Prof. Bocage (Jorn. Sci. Lisb. 1890, 2 ser. iv. p. 269), and have come to very much the same conclusions. Without definitely separating the forms, that from Hanha is described as a new species, a fully adult specimen being taken as the type. When more complete series are obtained the various forms may be found to be separable into local subspecies; but as fully adult specimens are still wanting from several of the localities, I do not see my way at present to divide them.

G. damarensis, a white-spotted form, certainly occurs in Angola, for the British Museum contains a specimen collected there by Dr. Welwitsch, and some of the forms may be referred to this species; but most of the specimens are rather young for determination. *G. hottentottus*, *G. damarensis*, and *G. Bocagei*, having the naso-frontal suture of somewhat the same pattern, the skulls are difficult to distinguish when young. The occipital spot is undoubtedly a variable character, as I find in normally unspotted forms, such as *G. Nimrodi*, an occasional specimen with a small white spot, and in the normally large-spotted form, *G. Darlingi*, an occasional specimen turns up with only a very small white spot; thus it may be possible outwardly to almost perfectly match specimens of these two otherwise very widely distinct species; this only shows how necessary it is to have far larger series of these animals before we can say whether age, sex, or season has anything to do with their varying exteriors.

XXXVI.—*On the Excretory Organs and Blood-vascular System of* Tetrastemma graecense, *Böhmig*. (A Provisional Communication.) By Dr. L. Böhmig, of Graz *.

The freshwater Nemertine which I observed in the year 1892 in a reservoir in the Botanical Gardens here I have again discovered in greater numbers in the same place, and have been enabled to submit it to closer investigation. I devoted my attention especially to the excretory and sexual organs, and now give a short statement of some of the results of my researches.

Although the plates for my memoir on *Tetrastemma graecense* were finished a considerable time ago, the publication of the paper itself has been greatly delayed, partly in consequence of my professional duties and partly owing to the examination of a land Nemertine found in the hothouse of the local Botanical Gardens.

In specimens to which a moderately strong pressure has been applied there is readily recognizable on each side of the body a system of clear ramifying canals, from 4·26 to 11·36 μ in diameter, which communicate one with another and permeate the animal throughout its entire length. In the anterior extremity of the body, in the region of the brain and in front of it, I observed only a single canal of larger size, which was disposed in manifold sinuosities and loops, and ultimately became broken up into a fine close-meshed network of very small canalicules; at the posterior end of the body I failed to discover a terminal plexus of this kind. Into the coarser

* Translated by E. E. Austen from the 'Zoologischer Anzeiger,' Bd. xx. No. 523 (February 1, 1897), pp. 33-36.

network of canals, as well as into the finer one in the cephalic region, there open numerous fine straight canalicules, upon which lie the terminal organs, which are easily recognizable owing to the active movements of their cilia-flames. Information as to the finer structure of the excretory organs is afforded by microscopical sections. In these may be observed on each side, chiefly towards the dorsal surface and laterally to the intestine, a ramifying cord of cells of varying size, from which, however, isolated branches also pass over to the ventral side. There is no communication at any point between the two lateral cords of cells, although they sometimes approach so closely as almost to come into contact.

For the sake of clearness it appears to me to be advantageous from a descriptive point of view to distinguish three sections in the excretory organs—namely, the end-canalicules, upon which lie the terminal organs, the connecting canals, and the main canals.

The first-mentioned lie for the most part close beneath the dermo-muscular tube, and further on in immediate proximity to the wall of the intestine; their transverse diameter amounts to about 3 to 5 μ. Their wall consists of flat cells, which take but a slight stain, and the respective limits of which can only be made out with difficulty. The cell-plasma is homogeneous in character or else finely granular, not infrequently of greater density on the outer and inner surfaces, a fact to which the somewhat greater stainability of these cells is probably also to be ascribed. I never observed cilia or more strongly developed single flagella in the case of these cells.

The connecting canals which join the end-canalicules are distinguished from the latter not only by greater thickness, but also by the fact that the cells forming their boundaries possess a cylindrical shape and a more strongly granular, not infrequently finely vacuolate, protoplasm, which is capable of taking a more intense stain. These cells appear always to bear cilia, though I have succeeded in recognizing the delicate fringe of cilia only in certain preparations.

Lastly, if we examine sections through the main portion of the organ, we observe, in the first place, a complex of cells which is traversed by canals in all directions. Closer study, however, shows us that even here each canal has its own cellular wall, but that the cells of the different canals often lie extraordinarily close together, and that there are tracts where the limits of the cells are not recognizable. These cells vary considerably in size, but they are always larger than those of the connecting portions. Their plasma is granular and very frequently interspersed with a large number of vacuoles; they, too, in life probably possess a clothing of

cilia, although it was only now and then that I could perceive this distinctly in prepared sections.

The knobbed terminal organs, the outer surface of which is smooth, either rest with a relatively broad base upon the end-canalicules, which not infrequently ramify, or else the portion turned towards the canalicule is drawn out like a stalk; in the former case they are more bulky in shape, in the latter more elongate. Each terminal organ is closed at its free end by two flame-cells (more rarely one), from which delicate strands of plasma radiate into the mesenchyma; in the formation of its wall several—as it seems to me from three to five—cells take part, which in structure resemble those of the end-canalicule. In general it may be said that the end-canals open into the main canals not directly, but by means of the connecting portions; yet I have also seen a direct communication between the two.

The number of the excretory pores could not be determined with certainty in the living animal, but on examining the series of transverse sections from two individuals it was found that in the first case there were five pores on each side and in the second six on the one side and three on the other. The pores are always situated dorsally and at irregular distances one from another; in the case of the specimen, too, which possessed five pores on each side, those of the right side did not correspond with those of the left.

At the points at which excretory pores occur the excretory organ is applied closely to the dermo-muscular tube and the short efferent duct bores its way straight through dermo-muscular tube, basement membrane, and epithelium.

A more intimate relation between the nephridia and the blood-vessels, such as has been demonstrated by Bürger in the case of marine Metanemertines, especially *Drepanophorus*, does not exist in *Tetrastemma graecense*.

The blood-vascular system consists of three trunks, two lateral vessels and a dorsal vessel. The latter opens in front into the right lateral vessel close behind the brain, behind into the anal commissure between the two lateral vessels.

The wall of all these vessels is formed by an internal endothelium, a muscular sheath, and an outer layer of mesenchyma cells arranged in epithelial fashion. Now between the endothelium and muscular sheath large cells of hemispherical form and peculiar structure thrust their way; in the condition of diastole these cells stand out like knobs from the wall of the vessel, but in that of systole they project into its lumen. Since two cells of this kind always lie directly opposite to one another, or nearly so, they are able in systole to close the lumen almost completely and prevent a backward flow of the blood.

MISCELLANEOUS.

A new case of Care of the Brood in Holothurians. (Provisional Communication.) By Prof. Hubert Ludwig, of Bonn.

The number of sea-cucumbers which care for their brood known up to the present time amounts to seven, all of which belong either to the Dendrochirotæ or to the Synaptidæ. One species among them—*Phyllophorus urna*, Grube—utilizes the body-cavity as a brood-chamber, while in the case of *Cucumaria crocea* (Lesson) and *Psolus ephippifer*, W. Thomson, the eggs undergo their development upon the dorsum of the mother; in *Cucumaria lævigata* (Verrill) and *Cucumaria glacialis*, Ljungman, on the other hand, development takes place in special ventral brood-pouches (invaginations of the integument). With the exception of the Mediterranean *Phyllophorus urna*, all these Dendrochirotæ are arctic (*Cucumaria glacialis*) or antarctic forms (*Cucumaria crocea*, *C. lævigata*, *Psolus ephippifer*). In the case of the two Synaptidæ which care for the brood—*Synapta vivipara* (Erstedt) and *Chiridota rotifera* (Pourtalès)—both of which belong to the West-Atlantic marine region, the body-cavity serves as brood-chamber; herein these species resemble *Phyllophorus urna*. With reference to *Synapta vivipara*, Clark * has recently furnished us with details of the development and care of the brood, after I had previously given a brief notice † of the gastrula-stage found by me in the body-cavity of this species. As regards *Chiridota rotifera*, we possess only the fragmentary observations I published by myself in 1881 ‡.

That, however, there also exists an antarctic *Chiridota* in which care of the brood is well-marked, I am now in a position to show. The species in question is *Chiridota contorta*, which was described by myself in the year 1874, and of which I have now before me a more extensive series of specimens from the Hamburg Museum (obtained by the Hamburg-Magellan Collecting Expedition). In this species I discovered a form of care of the brood hitherto unknown either among Holothurians or in the case of any other Echinoderm. For in the female animals (the sexes in this species are separate, just as I can also show to be the case in *Chiridota*

* Clark, "The Viviparous *Synapta* of the West Indies" (Zool. Anz. 1896, p. 398), and "Notes on the Life-History of *Synapta vivipara*, Œrstedt" ('Journal of the Institute of Jamaica,' vol. ii. part 3, Kingston (Jamaica), 1896, pp. 278–282).

† Ludwig, "Die von Chierchia auf der Fahrt der kgl. ital. Corvette 'Vettor Pisani' gesammelten Holothurien," Zoologische Jahrbücher, ii. 1886, pp. 28–29. Clark does not refer to this publication, but, on the contrary, erroneously asserts that I described a specimen of *Synapta vivipara* as far back as 1881. My paper of the year 1881 ('Archives de Biologie,' ii. p. 41) refers not to *Synapta vivipara*, but to *Chiridota rotifera*.

‡ See previous note.

rufescens and *Chiridota Pisanii* *) the genital canals themselves become receptacles for the brood, and the entire development is passed through within them. The oldest stages of the young, which throng the genital canals in large numbers, are 3 millim. in length and are born through the genital aperture. They possess seven tentacles, exhibiting the same symmetrical arrangement as in the case of the young of *Chiridota rotifera* previously described by me. In their body-wall the wheel-papillæ † and the hook-shaped calcareous bodies, which are especially characteristic of the species and to the function of which Östergren ‡ has recently directed attention, are already well-developed; similarly the tentacles also are already provided with the same calcareous bodies as in the case of the adults. Among internal organs may be observed the calcareous ring, a ventral Polian vesicle, and a dorsal uncalcified stone-canal, as well as a typically coiled intestinal canal. The young lie sometimes with the anterior, sometimes with the posterior end towards the genital aperture.

In a younger stage the young are scarcely 1 millim. in length and possess but five tentacles; in the integument it is only in the three dorsal interradii that groups of wheels occur, one group in each close behind the tentacles and a second a short distance in front of the anus; the rudiments of the hook-shaped calcareous bodies of the integument, as well as of the calcareous rods in the tentacles, have only just begun to appear.

I shall endeavour to give a precise description of the young stages here alluded to of *Chiridota contorta*, which is now found to be viviparous, in my memoir upon the antarctic Holothurians collected by Dr. Michaelsen. I shall there also have an opportunity of clearing up the synonymy of the antarctic Synaptidæ (especially of *Chiridota purpurea*, Lesson, which has been misinterpreted by Studer as well as by Théel and Lampert), and, with reference to the antarctic (hermaphrodite!) *Cucumaria crocea*, which takes care of its brood, of giving a detailed account of the young forms, a large series of which I have at my disposal.—*Zoologischer Anzeiger*, Bd. xx. No. 534 (June 28, 1897), pp. 217–219.

* As to this, I have already published a note in my treatise on sea-cucumbers in Bronn's 'Classen und Ordnungen,' p. 182, so that Dendy is in error in asserting, as he has just done, that he is the first to discover a separation of the sexes in a *Chiridota* (*Ch. dunedinensis*, Parker).—*Cf.* Dendy, "Observations on the Holothurians of New Zealand, with Descriptions of four new Species, and an Appendix on the Development of the Wheels in *Chirodota*," Journ. Linn. Soc., Zool. vol. xxvi. 1897, p. 28.

† The development of the wheels agrees perfectly with the account which I gave in 1892 of the origin and structure of *Chiridota*-wheels in general (Zeitschr. f. wiss. Zool. Bd. liv. pp. 350–364, t. xvi.). Dendy needs only to look at this paper, which he has left entirely unnoticed, in order to convince himself that it contains everything that he recently communicated as new concerning the mode of formation of *Chiridota*-wheels (*cf.* Dendy, *loc. cit.* pp. 49–50).

‡ Zool. Anz. 1897, p. 154.

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XXXVII.—*On the Cteniform Spiders of Ceylon, Burmah, and the Indian Archipelago, West and North of Wallace's Line; with Bibliography and List of those from Australasia, South and East of Wallace's Line.* By F. O. PICKARD CAMBRIDGE, B.A.

[Plate IV.]

CONTENTS.

	Page
(i.) Introduction	330
(ii.) *a.* List of Species noted in the Text, and New Species described and figured	330
b. Bibliography relating to the Cteniform Spiders of Ceylon, Burmah, &c.	331
(iii.) Genera and Species of 2-clawed Forms, with Notes on Types and Descriptions of New Species	332
(iv.) Genera and Species of 3-clawed Forms, with Notes on Types and Descriptions of New Species	350
(v.) Bibliography relating to Cteniform Spiders from New Guinea &c., and List of Species	354

Note.—On page 68 Ann. & Mag. Nat. Hist., Jan. 1897, I have, in the short diagnosis there given of the genus *Cupiennius*, Sim., based on this author's identification of a specimen as *C. oculatus*, Sim. (= *Ctenus Salèi*, Keys.), stated that the tarsal claws are *two*. This is not correct; there are three distinct tarsal claws, but the large claw-tuft on each side renders it very difficult to detect the inferior claw. *Cupiennius Salèi* apparently comes very close to my genus *Lycoctenus*, from which it is distinct, however, amongst other characters by the absence of spines beneath the tarsi and by the presence of the large claw-tufts.

(i.) *Introduction.*

The following paper includes spiders of the group *Ctenince*, as well as others belonging to the 3-clawed forms of those which have the characteristic Ctenoid eye-formula. Of the new species, one was taken by Mr. S. S. Flower in Pinang, two were taken by Mr. C. W. Hose in Borneo, while a fourth was taken in Ceylon by Mr. W. Barnes. One new species occurred in the Keyserling collection and two more were found in the Museum collection. So far as the material at my disposal permits one to judge, there is no generic distinction between the 2-clawed forms found in these regions and those in Central, Equatorial, and Southern America.

Of the 3-clawed forms, however, those included in my last paper on the genus *Lycoctenus* are quite distinct generically from those which Simon included under (*Titurius*) *Thalassius* and Thorell under *Dolopœus*. One cannot refrain from remarking on the infinite trouble which authors are laying up for those that come after by publishing meagre descriptions of new species without any figures. Even in cases where descriptions are elaborately minute, there has in many instances been no attempt at selecting the salient differential characters. Unless the descriptions of authors are *consciously comparative*, numbers of characters common to a whole genus will be constantly repeated, while, as likely as not, the one vital differential character will be overlooked, thus rendering the whole work useless and vexatious.

Mr. R. I. Pocock, of the Natural History Museum, has kindly allowed me to examine all the Eastern Cteniform spiders in the collection and describe the new forms.

(ii.) a. *List of Species noted in the Text.*

1887. *Ctenus trabifer*, Thor.—Burmah. P. 332, Pl. IV. fig. 14.
1887. *C. ramosus*, Thor.—Burmah. P. 333.
1887. *C. obscurus*, Thor.—Burmah. P. 334.
1890. *C. funyifer*, Thor.—Pinang. P. 334.
1890. *C. bicostatus*, Thor.—Borneo. P. 334.
1891. *C. trabifer*, Thor., Karsch.—Ceylon. P. 335, Pl. IV. fig. 13.
1892. *C. pulvinatus*, Thor.—Sarawak. P. 335.
1893. *C. Pollii*, van Hass.—Sumatra. P. 336.
1893. *C. argentipes*, van Hass.—Sumatra. P. 336.
1895. *C. barbatus*, Thor.—Burmah. P. 337.
1895. *C. denticulatus* (Sim.), Thor.—Burmah. P. 337, Pl. IV. figs. 4–9.
1882. *Leptoctenus valvularis*, van Hass.—Sumatra. P. 338, Pl. IV. fig. 16.
1884. *L. denticulatus*, Sim.—Burmah. P. 338.
1888. *L. tumidulus*, Sim.—Tavoy. P. 339.
1893. *L. agalenoides*, L. K., van Hass.—Sumatra. P. 340.

1879. *Anahita fauna*, Karsch.—Japan. P. 340.
1890. *Acanthoctenus variatus*, Thor.—Isl. of Nias. P. 340.
1891–2. *A. dimidiatus*, Thor.—Sumatra. P. 341.
1891–2. *A. lætus*, Thor.—Borneo. P. 341.
1891–2. *Nydia punctata*, Thor.—Sumatra. P. 342.
1885. *Thalassius marginellus*, Sim.—India. P. 352.
1893. *T. spathularis* (van Hass.). P. 353.
1895. *T. albocinctus* (Dol.), Thor.—Burmah. P. 353.
1884. *Titurius marginellus*, Sim.—Bankok, &c. P. 353.
1891. *Dolopœus cinctus*, Thor.—Nicobar Isles. P. 353.
1858–59. *Dolomedes albocinctus*, Doles.—Java. P. 354.
1882. *D. spathularis*, van Hass. P. 354.

New Species described and figured.

Ctenus Thorellii, sp. n., ♂ ♀.—Ceylon. P. 342, Pl. IV. figs. 2, 15, 27.
C. Hosei, sp. n., ♂ ♀.—Borneo. P. 345, Pl. IV. figs. 11, 17, 20, 28–30.
C. sarawakensis, sp. n., ♀.—Borneo. P. 346, Pl. IV. fig. 3.
C. ceylonensis, sp. n., ♂ ♀.—Ceylon. P. 346, Pl. IV. figs. 12, 26.
C. Floweri, sp. n., ♂ ♀.—Pinang. P. 348, Pl. IV. figs. 22–25.
C. philippinensis, sp. n., ♀.—Philippines. P. 349, Pl. IV. fig. 1.
Thalassius Simoni, sp. n., ♀.—Borneo. P. 351, Pl. IV. figs. 18, 21.
T. Doleschallii, sp. n., ♀.—Borneo. P. 352, Pl. IV. fig. 19.

(ii.) b. *Bibliography relating to the Cteniform Spiders of Ceylon, Burmah, Indo-Malaysia, China, and Japan, also of New Guinea and Australasia.*

1805.—C. A. Walckenaer. 'Tableau d'Araignées,' p. 16. (Type of genus *Ctenus*.—French Guiana, S. America.)
1833.—M. Perty. 'Del. Anim. Bras.' iii. (Spix and Martius), p. 133. (Type of genus *Phoneutria*.—Rio Negro, Brazil.)
1875.—L. Koch. 'Arachniden Australiens,' ii. p. 994. (Type of genus *Leptoctenus*.—Gayndah, Australia.)
1879.—Karsch. Verhandlungen Rheinprovinz, iv. p. 103. Japan.
1882.—A. R. van Hasselt. Naturlijke Historie, Midden Sumatra, pt. 11 *a*, p. 45. (*Leptoctenus valvularis*.—Sumatra.)
1884.—Eugène Simon. Ann. Mus. Genov. xx. pp. 328 & 355. (*Titurius* and *Leptoctenus dimidiatus* and *denticulatus*.—Burmah.)
1885.—Eugène Simon. Bull. Soc. Zool. Fr. p. 13. (*Thalassius* for *Titurius*, nom. præocc.)
1887.—T. Thorell. Ann. Mus. Genov. (2 *a*) vol. v. (xxv.) p. 288. "Ragni Birmani." (*Ctenus trabifer*, *ramosus*, and *obscurus*.—Burmah.)
1888.—Eugène Simon. Journ. Asiatic Soc. Bengal, lvi. ii. p. 108. (*Leptoctenus tumidulus*.—Tavoy, Burmah.)
1890.—T. Thorell. Ann. Mus. Genov. (2 *a*) vol. x. (xxx.) p. 34. "Arachnidi di Nias e di Sumatra." (Type of *Acantheis* [for *Acanthoctenus*, Keys., Thor.] *variatus*.)
1890.—T. Thorell. Ann. Mus. Genov. vol. x. (xxx.) p. 133. (*Ctenus bicostatus*.—Borneo.)
1890.—T. Thorell. Ann. Mus. Gen. (2 *a*) vol. x. (xxx.) p. 45, Nov. 17–Dec. 27. "Arachnidi di Pinang." (*Ctenus fungifer*.)
1891-92. T. Thorell. Kongl. Svenska Vet.-Akad. Handl. xxiv. 2, p. 60. (Type of *Dolopœus cinctus*.—Nicobar Islands, Bay of Bengal. Also p. 61, *Acantheis* for *Acanthoctenus*, Keys., Thor.)

1891. Karsch. Berlin. ent. Zeitschrift, xxxvi. 2, p. 295. (*Ctenus trabifer*, Thor., Karsch.—Tabrobane, Ceylon.)
1891-92.—T. Thorell. Ann. Mus. Genov. (2 *a*) vol. xi. (xxxi.) p. 139. "Ragni Malesi e Papuani." (Type of *Nydia punctata*, Sumatra.—*Ctenus valvularis* (Van Hass.), Sumatra.—*Ctenus pulvinatus*, Borneo.—*Acanthoctenus dimidiatus*, Sumatra.—*A. lætus*, Borneo.)
1893.—A. W. M. van Hasselt. Tijdschrift voor Entomologie, xxxvi. p. 146. (*Ctenus* [an *Phoneutria*?] *Pollii*, Sumatra.—*Ctenus argentipes*, Sumatra.)
1895.—T. Thorell. 'Descriptive Catalogue of the Spiders of Burma.' Published by Brit. Mus. Nat. Hist.

(iii.) *Genera and Species of 2-clawed Forms, with Notes on Types and Descriptions of New Species.*

1805. *Ctenus*, Wlk. Tabl. Aran. p. 16. (Type *C. dubius*, Wlk., ♀.—Cayenne, French Guiana.)
1833. *Phoneutria*, Perty, Del. Anim. Bras. iii. p. 196. (Type *P. ferus*, Perty, ♀.—Rio Negro, Brazil.)
1875. *Leptoctenus*, L. Koch, Arach. Austr. ii. p. 994. (Type *L. agalenoides*, L. K., ♂.—Gayndah, Australia.)
1879. *Anahita*, Karsch, Verh. Rheinprovinz, iv. p. 103. (Type *A. fauna*, Karsch, ♀.—Japan.)
1891-92. *Acantheis*, Thor. Sven. Vet.-Ak. Handl. xxiv. 2, p. 61. (*Note*: Nom. for *Acanthoctenus*, Keys., Thor. Type *A. variatus*, Thor., ♀.—Sumatra.)

Species described under Ctenus.

1887. *Ctenus trabifer*, Thor. ♀ juv., 13⅓ mm. Ann. Mus. Genov. ser. 2 *a*, vol. v. May 31–Oct. 7, p. 288. Bhamò, Burmah (*Fea*). (Pl. IV. fig. 14.)
1895. *Ctenus trabifer*, Thor. ♀s ad., 17½ and 10½ mm. Spid. Burma. Tenasserim, Burmah (*Oates*).

Two examples in coll. Brit. Mus. Nat. Hist.

Of this species Thorell remarks, Ann. Mus. Genov. p. 291:—"Feminam unicam, quæ nondum adulta videtur, ad Bhamò cepit Fea.—*C.* (*Leptocteno*) *valvularis*, Van Hass. (Midden Sumatra cet. p. 45, pl. v. fig. 12), valde affinis est hæc species, colore ventris tamen plane alio facile dignoscenda."—It seems a pity to base a new species on a young female, confessedly so closely allied to another already described form, in a group in which the species run so closely together; for Thorell says of *pulvinatus* and *fungifer* that they also are both closely allied to *valvularis*. Although I have not been able to see the type, there are before me specimens identified by Thorell as *C. trabifer*, Thor., from Mr. E. W. Oates's collection from Burmah. These are distinctly different from *C. valvularis*, van Hass., judging by the figure of the vulva of the latter. They are also quite distinct from any of the other

forms now before me. The second example, the smaller, appears to be a dwarf form, in which the vulva is not so well developed. Should this form occur in any number and the males accompanying them offer any decided difference from males accompanying the larger form, it will probably have to be described as a new species.

The example of whose vulva I give a figure is not really closely allied to *calvularis*, *fungifer*, *javanus*, &c. The form of the vulva renders it very distinct from either, though of course in general characters all the forms described, except *denticulatus*, are very similar.

1887. *Ctenus ramosus*, Thor. ♂ ad., 13½ mm. Ann. Mus. Genov. ser. 2 *a*, vol. v. May 31–Oct. 7, p. 291. Bhamò, Burmah.

1895. *Ctenus ramosus*, Thor. Spid. Burma, p. xxvii.

♂. Tib. i. 5 pair spines beneath; antice 1, postice 1—1, supra 1—1—1. Tib. iii. and iv. supra 1—1—1. Protarsi i. and ii. beneath with 3 pair spines.

Measurements.—Tot. len. 13·5 mm., carap. 7·5, ant. marg. 2·5; legs i. 26·25, ii. 24·25, iii. 20, iv. 28·5; pat.+tib. iv. 9·5.

Tibia of pedipalp. "Ex apice hujus procursus, e basi communi latiore, exeunt alii procursus gracillimi cornei fusci duo, quorum alter spinam levissime incurvam, ipso apice in triangulum minutum dilatam, anteriora versus directam format, alter paullo fortior, deorsum et paullo intus directa est, fere in medio subito intus fractus et hoc loco extus dente foras directo armatus."—"Bulbus a latere visus partem longam crassam nitidam cylindratam a basi bulbi anteriora versus protensam ostendit, cujus apex subacuminatus deorsum curvatus est."—"Venter niger."—"Exemplum singulum adultum ad Bhamò invenit Fea. Marem præcedentis hanc araneam credere non possum, præsertim quum pedes plane alio modo aculeatos habeat."

The fact that the legs in this male present a different spinulation to that of "*trabifer*, ♀," need not, of itself, afford evidence of a specific distinction as Thorell suggests. In *C. ceylonensis*, sp. n., the difference in spinulation between the sexes is precisely as Thorell describes in *ramosus*, ♂, as contrasted with *trabifer*, ♀; while the males of all the *Ctenina* of the New World, so far as I have had experience of them, present the same difference. A male in Mr. Hose's collection from Borneo also presents similar differences from the females. From Thorell's description the tibia of the pedipalp in *ramosus* would seem to bear a general resemblance to that of *ceylonensis*, but certainly is not identical with it.

1887. *Ctenus obscurus*, Thor. ♀ ad., 9 mm. Ann. Mus. Genov. ser. 2 *a*, vol. v. May 31–Oct. 7, 1887, p. 295. Rangoon, Burmah (*Fea*).

1895. *Ctenus obscurus*, Thor. Spid. Burma, p. xxvii.

♀. Tib. i. and ii. 5 pair spines beneath, ii. with 2 spines besides on inner side. Protarsi i. and ii. 3 pair spines beneath. Tib. iii. and iv. above 1—1—1.

Measurements.—Tot. len. 9 mm., carap. $4\frac{1}{6}$, ant. marg. 1·5; legs i. 13·5, ii. 12, iii. 10·75, iv. 16; pat.+tib. iv. $5\frac{1}{3}$.

"Vulva ex area sat parva subpentagona, nitida, pallide fusca, ad utrinque angulum lateralem macula nigra notata constat, quæ postice truncata est, lateribus rectis sensim angustato-acuminata: hæc area excavata est et septa cruciformi munita, cujus ramus posterior, reliquis longior, foveas duas oblongas separat. Pone hanc aream callum fortem transversum convexum nitidum pallide fuscum video."

Thorell says of this species, the form of whose vulva is sufficiently difficult to grasp from the description, "pedibus longis et forma vulvæ notabili satis distincta est."

1890. *Ctenus fungifer*, Thor. ♀ ad., $9\frac{1}{2}$ mm. Ann. Mus. Genov. ser. 2 *a*, vol. x. (xxx.) Nov. 17–Dec. 27, p. 45. Pinang (*Loria & Fea*).

♀. Tib. i. and ii. 5 pair spines. Protarsi i. and ii. 3 pair spines beneath; no lateral spines. Tib. iii. and iv. 2–3 spines above.

Measurements.—Tot. len. 9·5 mm., ant. marg. 2; legs i. 13, ii. 11·5, iii. 11, iv. 16·5; pat.+tib. iv. 4·75.

"Vulva figuræ fungi (Agarici) humilis sat similis est: ex callo maximo, alto, deplanato, transverso et triplo-quadruplo latiore quam longiore constat, qui postice ample rotundatus est, antice in medio quasi in petiolum basi angustum, tum dilatatum productus et utrinque, apud eum, paullo emarginatus: apices rotundati hujus calli (pallide fusci) nigri sunt."

The general form of the vulva is clear from the description, and proves the species to be quite distinct from the females taken in Pinang by Mr. Flower, described below, though it must be closely allied to another form before me from Java, as well as to *valvularis*.

1890. *Ctenus bicostatus*, Thor. ♀ ad., 8·5 mm. Ann. Mus. Genov. Oct. 8, (2 *a*) vol. x. (xxx.) p. 134 (3). Borneo (*Doria & Beccari*).

♀. Tib. i. and ii. 5 pair spines. Protarsi i. and ii. 3 pair spines beneath.

"Vulva ex area subtrapezoidi pallide fusca constanti, quæ costas duas longitudinales parallelas nigras ostendit."

If this diagnosis fully describes the vulva, its form is quite simple, and certainly agrees with none of the species before me from Borneo.

1891. *Ctenus trabifer*, Thor., Karsch, Berl. ent. Zeitschr. xxxvi. 2, p. 295, Taf. xi. figs. 18 & 18 *b*. Tabrobane, Ceylon. (Pl. IV. fig. 13.)

Without actually seeing the types, one cannot pronounce on the identity of this species with certainty. That it is not identical with *trabifer*, Thor., as Dr. Thorell himself pointed out, admits of no doubt, since Thorell's own identifications of the latter are before me. At the same time, I have before me examples of two distinct species from Ceylon in the neighbourhood of Tabrobane (♂ and ♀). One of these presents a form of vulva similar in general outline to that of Karsch's figure; but either the drawing is not executed with sufficient minuteness of detail, or it depicts the vulva of a different species. In either case it would require a new name, and I am rather inclined to expect that it will prove identical with *C. ceylonensis*, sp. n., described below.

Karsch's figure and the vulva of *ceylonensis* belong to quite a different type from that to which *trabifer*, *Thorellii*, *Floweri*, *valvularis*, *pulvinatus*, &c. belong. The vulva reminds one rather of that of some species of European *Lycosa*.

1891–92. *Ctenus pulvinatus*, Thor. ♀ ad., 17 mm. Ann. Mus. Genov. ser. 2 *a*, vol. xi. (xxxi.) p. 139. Sarawak, Borneo (*Doria & Beccari*).

♀. Tib. i. and ii. 5 pair. Protarsi i. and ii. 3 pair spines beneath. Tib. iii. and iv. 1—1—1 above.

Measurements.—Tot. len. 17 mm., carap. 9⅓, ant. marg. 4·25; legs i. 23, ii. 21·5, iii. 19, iv. 27·5; pat.+tib. iv. 8·75.

Vulva. "Non multum a vulva *C. valvularis* differt. E lamina magna subtransversa, fortiter elevata, pæne plana, nitida, secundum medium late et leviter impressa, etc."

I have little doubt that the forms described below as *C. sarawakensis* and *Hosei* are quite distinct from either *valvularis* (*cf.* Pl. IV. fig. 16) or *pulvinatus*, Thor.; though the indistinctly annulated femora and tibiæ of iii. and iv. are common to the four species, *Hosei*, *sarawakensis*, *pulvinatus* (sec. Thor.), and *valvularis* (sec. Thor.), and indeed to all the eastern forms which have come before me to a greater or less extent, except *denticulatus*.

1893. *Ctenus* (an *Phoneutria*?) *Pollii*, van Hass. ♂, 22 mm. Type in coll. J. R. van de Poll, Bysenburg, Utrecht. Tijdschr. voor Ent. xxxvi. p. 146. *Hab.* Sumatra (*J. L. Kannezieter*).

♂. Tot. len. 22, carap. 12, abd. 10 mm. Pedes 4, 1, 2, 3. Ocular quadrangle nearly square. Posterior centrals a *little* larger than anterior centrals; 2nd row a little procurved. "Clypeo minimo"—"ventre in medio nigro, cum duabus seriebus longitudinalibus punctorum parvorum luteorum."—"Tarsi longe biunguiculati."—"Pars tibialis extus cum forti processu transverso, parumper sursum curvato, obtuso, sed ut videtur apice bifido; bulbi laminâ oblongato-ovatâ, tam supra, ad basin, processui tibiali vicinam, quam subtus ipso bulbo, in medio, dente conico provisâ, hoc illo multo validiore."

No mention is made of the spinulation, but doubtless it is the same as that of other species closely allied, which possess the characteristic rows of white spots beneath the abdomen. Without seeing the type, one is of course unable to say anything worthy of confidence, but I have not yet met with any forms from the east in which the ocular quadrangle is square and the anterior eyes only a little smaller than the posterior; though these forms occur in the Neotropics and others characterized also by rows of white spots beneath the abdomen. Dr. van Hasselt has most kindly informed me of the whereabouts of the type of this species.

♂ ad. *Hab.* Sumatra.

1893. *Ctenus argentipes*, van Hass. ♂, 16 mm. Tijdschr. voor Ent. xxxvi. p. 148. Type in coll. J. R. van de Poll, Bysenburg, Utrecht. *Hab.* Sumatra (*J. L. Kannezieter*).

♂. Tot. len. 16, carap. 8, abd. 8 mm. Pedes 4, 1, 2, 3.

In general appearance resembling *Pollii*; ocular quadrangle, however, broader than long; venter similarly decorated with rows of white spots, but *four* instead of *two*. Fem. iii. and iv. "late semiannulati vel maculati."—"Tibiis, præsertim supra, pulchre et dense sed non longe argenteo-albo pilosis (iii. excepto). Processus tibialis similaris, sed magis dentiformis, et ut videtur, non bifidus."—"Processus ad bulbi laminam basalis multo longior et magis incurvatus, quasi calcaratus, calcare hoc postrorsum versus dentem tibialem inclinato."

This species is evidently very similar in general appearance to *C. Floweri*, sp. n., though I am entirely unable to reconcile the above description of the palpal organs with those of *Floweri* (*cf.* Pl. IV. fig. 25), and I have not the smallest doubt about the distinctness of the two species, short of actual

comparison of the types. I have to thank Dr. van Hasselt for information concerning the type and other important notes.

♂ ad. *Hab.* Sumatra.

1895. *Ctenus barbatus*, Thor. ♀ juv., 8½ mm. Spid. Burma, p. 214. Kyeikpadem (Pegu), Burmah (*Oates*).

Of this immature form Thorell remarks, "Femina nondum adulta et plane detrita, quam singulam vidi."—"*C. trabifero* ad formam simillima, præter penicillo oris colore multo pallidiore præsertim agnoscenda."

Under the circumstances one could have wished this form had not been described as a new species, seeing that identification, from descriptions alone, is sufficiently difficult even in the case of adults. The type, which is before me, might well be the young of any of the forms of which the ventral area of the abdomen is marked with rows of spots.

1895. *Ctenus denticulatus* (Sim.), Thor. ♂ ♀ ad., ♀ 7·5–10 mm. Spid. Burma, p. 216. Rangoon and Tharawaddy, Kyeikpadem (*Oates*). (Pl. IV. figs. 4–9.)

Specimen identified by Thorell in coll. Brit. Mus. Nat. Hist., originally described in 1884—*Leptoctenus denticulatus*, Sim. Ann. Mus. Genov. xx. p. 355.

Genus Leptoctenus, L. K.

Whether *L. agalenoides* is or is not congeneric with the two-clawed ctenoid forms which are found in Sumatra and Borneo I cannot pretend to say. L. Koch himself says:—"Tibia i. and ii. 4 pair of spines" (whether he includes the apical pair or not, I cannot say); also "no scopula." The ctenoids from Borneo now before me have very distinct scopulæ on the anterior tarsi and protarsi, as well as the posterior tarsi; and 5 pairs of subtibial spines on i. and ii., one pair being apical. Otherwise, except that the anterior centrals are smaller in proportion in Koch's figure, one would conclude them to be congeneric. That the forms placed under *Ctenus* by Thorell (*C. pulvinatus*, *valvularis*, *trabifer*, &c.) are very closely allied to those of the New World, taking *albofasciatus*, ♀, as an example, there is no doubt—the only difference I can detect being in the constant presence of a minute fifth tooth on the lower margin of the fang-groove, which is missing in all examples of Bornean ctenoids which have come before me, though it may possibly appear in some species. Whether, as Thorell suggests, *Leptoctenus*, L. K., differs from *Ctenus*, Walck. (*C. dubius*), or from *Isoctenus*, Bertk., is not easy to say in the absence of types.

I have no doubt that *L. valvularis*, van Hass., is congeneric with *pulvinatus* and *trabifer*; an example of the latter, identified (not the type) by Dr. Thorell e coll. E. W. Oates, being now before me. So similar is *albofasciatus* to *pulvinatus* and *valvularis* (according to the descriptions) that even the four rows of ventral white spots are common to these forms.

Species described under Leptoctenus, *L. K.*

1882. *Leptoctenus valvularis*, van Hass. ♀, 13 mm. IV. 3de Aflev. Naturlijke Historie, pt. 11 *a*, p. 45, pl. v. fig. 12 (Leiden). Sumatra (*Pick van Korintzi & Sir A. van Hasselt*). Type in coll. Bijks Nat. Hist. Mus. Leiden. ♀, Pl. IV. fig. 16 (*after van Hasselt*).

♀. Tot. len. 13, carap. 6, abd. 7 mm. Tibiæ 2.2.2.2 spines and 2 apical spines. "Abdominus nigro-fuscus, in ventris medio paullo lætior absque picturâ evidente, quamquam vestigia obscura serierum lateralium punctorum et striarum oblique transversarum (*Lycosiformium*) sub lente apparent."

The general character is evidently similar to that of *Thorellii* and to another form before me from Japan, but is quite distinct from the former, judging by van Hasselt's figure (see Pl. IV. fig. 16 for reproduction), and also, so far as one can judge without comparing the types, from the latter.

1884. *Leptoctenus denticulatus*, Sim. ♀, 8·5 mm. Ann. Mus. Genov. xx. p. 355. Burmah.

Leptoctenus denticulatus (Sim.), Thor. ♂ ♀. *Hab.* Burmah (*coll. W. Oates*). Examples in coll. Brit. Mus. Nat. Hist.

♂.—*Structure.* Carapace horizontal, not gibbous behind, but still slightly raised and convex; abruptly inclined to base. Eyes closely grouped; 2nd row straight by centres. Posterior centrals one third larger than anterior centrals, half a diameter apart, distant from anterior laterals one half a diameter of latter. Ocular quadrangle broader than long, much narrower in front. Posterior centrals one third larger (by diameters) than anterior centrals; the latter one quarter of a diameter apart, one half from anterior margin of clypeus. Tibiæ i. and ii. with 2—2—2—2—2 long spines beneath; no apical pair; 1 basal spine on inner side, 1—1 dorsal, 1—1 on outer side. Protarsi i. and ii. with 2.2.2 long spines beneath, 1—1 spines on inner side, and 1—1 on outer side; no dorsal spines. Patellæ i., ii., iii., iv. with 1 spine on each side. Pedipalp, see Pl. IV. figs. 4, 5, 6.

♀.—*Structure.* Similar to that of male, but carapace horizontal. Tibiæ i. and ii. with no lateral or dorsal spines,

except 1 towards base on outer side of tib. ii. Patellæ with spines as in male. Eyes not quite so closely grouped.

Sternum scarcely longer than broad, circular. Maxillæ broad at base (Pl. IV. fig. 9). Labium scarcely longer than broad, less than half the length of maxilla.

Tarsal claws two. Claw-tuft present; scopula present, but very slight.

The male and female described by Thorell, now before me, are most probably (sec. Simon's description) identical with *L. denticulatus*, Sim. As no figures of the species have been published, I take this opportunity of figuring it. I am, however, if those forms identified by Thorell as *denticulatus* are really so, not able to reconcile Simon's reference to the spinulation of patella iv. In comparing *denticulatus* with *Leptoctenus agalenoides*, L. K., Simon regards the former as differing in the number of tibial spines (5 instead of 4); also in the number of spines on patella iv., two instead of one on each side; also in the presence of the scopula.

The forms which Thorell has referred to *denticulatus*, Sim., certainly both male and female, have but *one* spine on each side of patellæ i., ii., iii., and iv.

1888. *Leptoctenus tumidulus*, Sim. ♂ "pullus," 15 mm. Journ. Asiatic Soc. Bengal, lvi. pt. ii. p. 108. Tenasserim, Tavoy, Burmah.

♂. 15 mm., young. "Cephalothorax posticus valde convexus."—"Oculi fere ut in *L. denticulato* sed area mediorum latius transversa et oculis lateralibus seriei 2ª a mediis latius remotis. Clypeus oculis anticis haud latior, retro obliquus. Chelæ margine inferiore sulci quadridentato, dentibus 1 et 2 reliquis paulo majoribus. Tib. anticæ infra 5—5 aculeatæ (iii. reliquis longioribus). Metatarsis aculeis similibus 3—3." —Tib. + pat. iv. almost equal to carapace.—"*L. denticulato*, E. Sim., affinis, differt imprimis cephalothorace postice convexiore, pedibus brevioribus, etc."

I extract the above from M. Simon's description of this species for the sake of forming some idea of its generic affinities, though one cannot consider a description drawn from an immature specimen to be of much value for purposes of identification. One is at a loss to understand how so able and experienced an arachnologist should allow himself to base new species on immature examples. There is quite sufficient labour already handed down to posterity in identifying adult forms, briefly described, unaccompanied by a single figure, without thus increasing the confusion by mere descriptions of immature forms.

1893. *Leptoctenus agalenoides*, L. K. ♀ (var.?). Van Hass. Tijdschr. voor Ent. xxxvi. p. 145. *Hab.* Sumatra. Van Hasselt gives this as doubtfully the female of L. Koch's species.

1893. *Ctenus trabifer*, Thor. ♀ (juv.). Van Hass. Tijds. voor Ent. xxxvi. p. 146. *Hab.* Ceylon?? Doubtfully referred to *C. trabifer*, Thorell.

1893. *Ctenus* ——. ♀. Van Hass. Tijds. voor Ent. xxxvi. p. 146. *Hab.* Ceylon?? "*C. valvularis* (mihi) subsimilis, genitalis valvula quantoque variante."

Dr. van Hasselt has considerately refrained from describing the immature female from Ceylon as a new species.

Species described under Anahita, *Karsch.*

1879. *Anahita fauna*, Karsch. ♀. Verh. Rheinprovinz, Bd. iv. p. 103. Japan.

In the description of this form, the type of *Anahita*, which Karsch considers near *Zora* and *Apostenus*, though Keyserling refers it to *Ctenus*, there is no mention of the spinulation of the legs. The eyes are in three parallel lines and the tarsal claws two. One cannot, without seeing the type, risk a guess as to its systematic position.

ACANTHEIS, Thor.

Diagnosis.— ♂. Tarsal claws 2. Sternum circular. Eyes *ctenoid*, 2nd row procurved. Lower margin of fang-groove with 5 teeth. Carapace gibbous behind. Tibiæ i. and ii. with 9 pairs of long spines beneath; protarsi i. and ii. with 5 pairs of long spines beneath.

This diagnosis is drawn from an example, evidently congeneric with Thorell's forms, from Borneo.

Species described under Acanthoctenus, *Thor.*

1890. *Acanthoctenus variatus*, Thor. ♀ juv., $9\frac{3}{4}$ mm. Type of genus. Ann. Mus. Genov. ser. 2 *a*, vol. x. (xxx.) Sept. 4, 1890, p. 34. Bawo Lowalani, Nias (*Modigliani*).

"Tibiis anterioribus modo subter aculeatis, 9 paribus aculeorum ibi armatis, metatarsis anterioribus subter 5 paribus aculeorum munitis."

Measurements (sec. Thor.).—Tot. len. 9·75 mm., carap. $4\frac{2}{3}$, ant. marg. 1·5; legs i. 21·5, ii. 19·5, iii. 16·75, iv. 26·5; pat. + tib. iv. 8; prot. + tars. iv. 10·5.— ("Cribello et

calamistro carent hæc aliæque species Indo-Malajanæ generis *Acanthocteni*, mihi, notæ.")

One would scarcely hope to determine the identity of this species from a description taken from an immature female.

1891–92. *Acanthoctenus dimidiatus*, Thor. ♂ ad., 9¾ mm. Ann. Mus. Genov. ser. 2 *a*, xi. (xxxi.) p. 142. Mt. Singalang, Sumatra (*Beccari*).

Measurements (sec. Thor.).—Tot. len. 9·75 mm., carap. 5⅛, ant. marg. 1·75; legs i. 27·75, ii. 25, iii. 22·5, iv. 30⅔; pat.+tib. iv. 9·75.

"Palpi longi, graciles, clava patellas anticas latitudine circiter æquanti. Pars patellaris 2½–3-plo longior est quam latior, pars tibialis eâ non parum longior et saltem basi paullo angustior, pæne cylindrata, a basi ad apicem sensim modo levissime incrassata; latus ejus exterius prope apicem in dentem conicum acuminatum anteriora versus et foras directum excurrit, cujus longitudo ⅓ diametri partis tibialis vix superat.

"Pars tarsalis — circa triplo longior est quam latior. Bulbus parum plus dimidium basale partis tarsalis occupat. Breviter subellipticus est, modice altus et complicatus, in medio lateris exterioris, subter, elevationem nitidam subovatam sat magnam ostendit, et prope eam, in medio subter, partem quandam ferrugineam, quæ, quam a latere exteriore inspicitur bulbus, postice dentem deorsum directum procurvum ibidem formare videtur, præterea vero in procursum gracilem porrectum apice profundo bifidum sive furcatum excurrit.

"Ceph. et abd. subfuscis, fascia media angusta alba ab oculis ad anum ducta ornatis, abdominis dorso præterea saltem posterius ordinibus duobus longitudinalibus macularum magnarum nigrarum notato."

An adult male, obviously belonging to this genus, but specifically distinct from Thorell's species, is now before me from Borneo. One can well understand Thorell's supposition as to its being congeneric with *Acanthoctenus*, Keys., of which the type is before me.

1891–92. *Acanthoctenus lætus*, Thor. ♂ ad., 10⅔ mm. Ann. Mus. Genov. ser. 2 *a*, xi. (xxxi.) p. 146. Sarawak, Borneo (*Doria e Beccari*).

Measurements.—Tot. len. 10⅔ mm., carap. 5·5, ant. marg. 1·75; legs i. 32, ii. 28·25, iii. 24·5, iv. 36; pat.+tib. iv. 10·5.

"Palporum clava—pars eorum patellaris duplo et dimidio longior est quam latior; pars tibialis eâ saltem ¼ longior est,

a basi ad apicem sensim pallulo incrassata, pæne 4-plo longior quam latior; prope apicem lateris exterioris, supra, dente sat parvo sed forti, paullo deorsum curvato, anteriora versus et paullo foras directo armata est, cujus apex in duos dentes acuminatos est fissus.

"Pars tarsalis—pæne triplo longior quam latior, ad formam ut in *A. dimidiato*, modo apice paullo breviore. Bulbus a latere exteriore visus paullo ante medium subter rotundato excisus videtur, ita ut dentem deorsum et anteriora versus directum hic formet pars excisa, quæ supra, antice, in procursum sat brevem et latum, apice dilatum, porrectum (non ut in priore specie profunde bifurcatum) producta est.

"Ceph. in fundo luteo-ferrugineo, pube densa flava et rubro tecto, itaque flavo, pictura rubra.

"Abdomine in fundo subtestaceo, secundum medium dorsi late flavo, pube flava, intermixta rubra, quæ maculas saltem ad partem in ordines duos longitudinales dispositos format, vestito." *

Species described under Nydia, *Thor.*

1891–92. *Nydia punctata*, Thor. ♀ juv., 6½ mm. Ann. Mus. Genov. ser. 2 *a*, xi. (xxxi.) p. 131. Sumatra (*Forbes*) : e coll. O. P. C.

Dr. Thorell says of this, the type of a new genus, "unicam feminan nondum adultam, detritam et valde mutilatam (pedibus plerisque carentem) hujus araneæ vidi."

It is much to be deplored that an experienced arachnologist like Dr. Thorell should take a much mutilated specimen, an immature female, and one which has lost several legs, as the type of a new genus.

New Species of Ctenus.

I hesitate to attempt to draw up a synoptic table of species without more material to substantiate my conclusions as to specific differences. The form of the vulva is, however, the only really reliable character, and of this portion of structure a figure has been given.

Ctenus Thorellii, sp. n, ♂ ♀. (Pl. IV. figs. 2, 15, 27.)

Hab. Ceylon.

Type in coll. Brit. Mus. Nat. Hist. e coll. Keyserling.

♀. 22 mm.

♂.—*Colour.* Carapace mahogany-brown, with broad

* *Acantheis tridens*, F. Cb., Abhandl. d. Senckenb. naturf. Gesellsch. Bd. xxiii. 1897. Baram River, Borneo (*W. Kükenthal*).

central and marginal band of grey pubescence, the former constricted behind caput, attenuate behind central stria, extending from ocular area to posterior margin. Shoulders of posterior portion of carapace with triangular dark blotch on each side. Sternum, legs, and mandibles dark mahogany-brown. Legs clothed with grey pubescence. Abdomen grey, with shoulders, two fine dorsal basal lines, and double series of 3–4 spots sooty brown. Ventral surface sooty black, with two short central pale lines immediately behind the genital foramen, and two long pale lines, closer to the margins of the black area, extending from the genital foramen to the spinners.

Femora and tibiæ of iii. and iv. with scarcely any indication of dusky annulations. Tibiæ i. and ii., iii. and iv. uniformly grey, with conspicuous white bands.

♀.—*Colour*. The same as that of the male, except that the central band on carapace consists of rufous-grey pubescence.

♂.—*Structure*. Carapace distinctly gibbous behind and abruptly inclined to posterior margin. Sternum longer than broad. Labial plate more than half the length of maxilla, longer than broad. Maxillæ attenuate at base, outer margin nearly straight or concave; apex broad, rounded on outside, obliquely truncate on inner side. Fang-groove with 4 and 3 denticles on inferior and superior margin respectively. Legs iv. longer than legs i. Carapace longer than patella + tibia iii. Pat. + tib. i. = iv. *Eyes*. Second row straight; straight line touching posterior margins of laterals passes through centre of centrals. Ocular quadrangle broader than long, narrower in front; anteriors much ($\frac{1}{3}$) smaller; posteriors less than 1 diameter apart; anteriors less than 1 diameter apart. Anterior laterals oval, nearly one diameter from posterior centrals (in female quite one diameter). Posterior laterals scarcely larger than anterior centrals. Clypeus less than one diameter of anterior centrals.

Legs. Femora i., ii., iii., iv. with 10–11 spines above. Patellæ i., ii., iii., iv. with one spine on each side. Tibiæ i. and ii. with 5 pairs of spines beneath (including apical pair); 1—1 lateral, basal, spines on each side; 1—1—1 dorsal spines. Protarsi i. and ii. with 3 pairs of spines beneath, 1—1 lateral basal spines on each side. Tibiæ iii. and iv. with 3 pairs of spines beneath, 1—1 lateral, on each side, and 1—1—1 dorsal spines. Protarsus iii. with 3 pair spines beneath, 1—1—1 lateral, 1—1 dorsal spines; iv. with numerous spines irregularly arranged. Tarsi and protarsi i. and ii. slightly scopulate, iii. and iv. not scopulate. Tarsal claws 2.

Pedipalp. *Tibia* three times as long as broad (excluding width of process). On outer side at apex is a stout bifid spur, its outer limb shorter and sharply conical, the inner branch a little longer, dilate, and squarely truncate at apex. *Tarsus* two and a half times as long as broad, produced on outer side at base into a short, straight, compressed conical spur, its apex directed outwards. Area of palpal organs small, oval. Central lobe simple, curved, twice as long as broad, not produced at base. Unca stout, curving over the apex of central lobe, its apex grooved on outer surface. Beneath apex of unca lies a small pale membranous sheath, which is present in some form or other in numerous species.

♀.—*Structure*. Similar to that of the male, except that the carapace is less gibbous at base, the lateral anterior eyes are rather more removed from the central posteriors, and the spinulation of the legs is different. Tibiæ i. and ii. 5 pairs beneath; no laterals and none above. Protarsi i. and ii. with 3 pairs beneath; no laterals and none above. Patellæ i. and ii. without spines, iii. and iv. with one lateral spine on each side. Tarsi of all four pairs distinctly and thickly scopulate; protarsi i. and ii. only scopulate.

Tarsal claws 2.

Vulva a little longer than broad, globular ovate, convex and plane above (without central depression or furrow), with black coriaceous margins; on each side of lateral margins, just behind the centre, lies a small, stout, conical spur, curving upwards and backwards, its apex well separated from margin of vulva.

The species *Hosei*, *sarawakensis*, *borneensis*, and *ceylonensis* are all approximately similar to this form in general characters, so that there is no need for a tedious repetition of them. *Floweri* and *trabifer*, however, present characters in common which are somewhat different; while those of *denticulatus* are different in some respects from either of these two forms.

I strongly suspect that it was on a male of either *Floweri* or *trabifer* that L. Koch based his genus *Leptoctenus*, but am not yet in a position to give a reliable opinion. The presence of the scopula might easily be overlooked, and it seems by the figure that in Koch's *Leptoctenus* there are five pairs of subtibial spines. The form of the labium and maxillæ, of which Koch gives figures, precludes the idea that Simon's *L. denticulatus* is congeneric with it.

A male and female of this species, recorded from Ceylon, were found in the Keyserling collection in the Natural History Museum, South Kensington.

Ctenus Hosei, sp. n.
(Pl. IV. figs. 11, 17, 20, 28–30.)

Measurements.—♂. Tot. len. 17 mm., carap. 9·5; legs i. 31, ii. 30, iii. 25, iv. absent; ant. marg. of carap. 3·75; pat.+tib. i. 12, iii. 8.

♀. Tot. len. 22 mm., carap. 10; legs i. 29, ii. 27, iii. 23·5, iv. 33·5; ant. marg. of carap. 5; pat.+tib. i. 10, iii. 8, iv. 9·75.

♂.—*Colour.* Carapace mahogany-brown, with broad central band of silvery-grey pubescence, with a pair of obscure dark spots behind eyes and attenuate at base of carapace. Marginal grey band broad. Abdomen with double dorsal series of obscure dark spots, or with broad pale dentated band, the marginal interstices picked out with black. Dark brown beneath, with two more or less distinct white lines and two shorter ones immediately behind vulva. Legs paler mahogany-brown, very indistinctly annulated beneath femora. Apical half of tibiæ of all four pairs of legs (iv. absent?) clothed with silvery pubescence. Coxæ of legs clothed with silvery-grey pubescence above.

♀.—*Colour* similar to that of the male, but no silvery-white pubescence on tibiæ or carapace. Pubescence rufous grey.

♂.—*Structure.* Carapace gibbous behind, abruptly inclined to base. In other respects similar to that of *C. Thorellii*.

♀.—*Structure.* Carapace horizontal above, abruptly inclined to base. Otherwise similar to that of *C. Thorellii*.

Pedipalp. Tibia one third longer than broad, with a short, broad, curved, dark apophysis on outer side, squarely but irregularly truncate at apex. *Tarsus* short and very broad, produced at base above into a stout pointed cone, terminating in a thin aculeate spur, strongly curved, directed outwards.

Palpal organs broad, simple. Central lobe small, produced on inner side at base; beyond its apex are two short spurs, lying close together, their points directed outwards.

Vulva as broad as long, convex; a black corneous margin encloses a transverse oval paler space, including a low convex tubercle on each side, and converges behind, forming a narrow transverse plate curving downwards. On each side of this plate is a corneous dentiform process, its point directed inwards.

Two females and a male of this large and handsome *Ctenus* were taken at Sarawak by Mr. C. H. Hose, while a male was also taken in Borneo by Dr. Kükenthal. This species, though larger, closely resembles in general appear-

ance several other species from the same regions. The figure of the vulva and pedipalp should, however, render the identification of either sex comparatively easy.

Ctenus sarawakensis, sp. n., ♀.
(Pl. IV. fig. 3.)

Hab. Sarawak, Borneo.

Types in coll. Brit. Mus. Nat. Hist. (e coll. Hose).

♀. Tot. len. 15·5 mm., carap. 7; legs i. 21, ii. 19, iii. 17, iv. 24; ant. marg. of carap. 3; pat.+tib. i. 7·5, iii. 5, iv. 7.

Colour similar to that of *Hosei*. Pubescence of abdomen copper-coloured, with traces of dorsal and ventral blotches as in the other species.

Structure. Spines and general characters similar to those of *Thorellii*. Carapace slightly gibbous behind and abruptly inclined to base.

Vulva longer than broad, disk broadly transverse and uniformly convex, narrowed before and behind, with a wedge-shaped raised carina anteriorly. Margins of disk black and coriaceous. On each side of the posterior margin lies a long sinuous dentate process, their apex extending distinctly beyond the posterior margin of disk and slightly converging.

Though scarcely distinguishable in general characters, except for their smaller size, from *Hosei*, *Thorellii*, and others, the form of the vulva furnishes evidence that they are distinct from these other forms.

Three females, taken by Mr. Hose at Sarawak, Borneo.

Ctenus ceylonensis, sp. n., ♂ ♀.
(Pl. IV. figs. 12, 26.)

Hab. Ceylon.

Type in coll. Brit. Mus. Nat. Hist. (e coll. Barnes).

♂. Tot. len. 13 mm., carap. 6·5; legs i. 26, ii. 24, iii. 20, iv. 28; ant. marg. of carap. 3; pat.+tib. i. 9, iii. 6·25, iv. 8·5.

♀. Tot. len. 18 mm., carap. 7·25; ant. marg. of carap. 3·5; legs i. 21·5, ii. 20, iii. 18, iv. 24; pat.+tib. i. 7, iii. 5·5, iv. 7.

♂.—*Structure.* Spines and general characters as in *Thorellii*. Carapace gibbous behind, abruptly inclined to base. Eyes: second row *straight by centres*; ocular quadrangle broader than long, narrower in front; post. centrals one half larger than ant. centrals, two thirds a diameter apart, distant from lat. ant. half a diameter of the latter; ant. centrals half a diameter apart, one diameter from anterior margin of clypeus.

Pedipalp. Tibia four times longer than wide, furnished on outside at apex with a pair of excentrically curving spines or slender spurs; the lower compressed, sinuous, bordered, spiraliform, its apex aculeate, directed upwards; the upper spur very slender, but broadly dilate at base, its inner basal margin irregularly denticulate or serrate, curving upwards, semicircular, attenuate towards apex, slightly sinuous immediately before apex, which is dilate beneath and curved strongly downwards. *Tarsus* one half longer than broad, bulb small, central lobe four times longer than broad, recurved beneath at anterior margin; a short curved spur represents the unca.

Colour similar to that of female.

♀.—*Structure.* Spines and general characters similar to those of *Thorellii*. *Eyes* similar to those in the male.

Colour. Carapace dark olive-brown, with broad paler central band, irregularly dilate on caput and before central stria, narrowed to basal margin. Legs i., ii., and iii. olive-brown, freckled with spots of grey pubescence; iv. olive-brown, with pale narrow dorsal line on tib. and prot. iv. (In the male all four pairs of legs are clothed with pale grey pubescence.)

Abdomen pale olive-brown, with central series of four (or five) paler chevron-like marks, each interstice picked out with black. Sides marked with oblique lines of pale spots. Ventral surface covered with four conspicuous rows of white spots and a pair of short central lines, becoming obsolete before spinners.

Vulva consisting of an elongate convex process, emarginate on each side and clothed with hairs, presenting posteriorly a cross piece whose ends curve slightly forwards. In front of each arm, in the angle formed by the junction of the two limbs of this ⊥-shaped structure, lies a stout curved denticle, its point directed upwards. The right side in the female before me is malformed, so that the vulva is not bilaterally symmetrical.

This species differs from the Bornean forms and from *Thorellii* by the closer proximity of the lateral anterior eyes to the posterior centrals and the fact that the second row of eyes is straight by their centres. Otherwise there is little to choose between them in general character.

That this form is closely allied to *C. trabifer* of Karsch (which has nothing to do with *trabifer*, Thorell, judging by examples of the latter identified by Thorell) is beyond doubt. I fully expect them to be identical; but without seeing Karsch's type, and in the face of Karsch's figure of the vulva,

I dare not pronounce them to be so. Both forms occur in the island of Tabrobane. The vulva differs in form from those of all other Ctenidæ which I have yet met with.

A male and a female of this interesting species were taken by Mr. Barnes in Ceylon *.

Ctenus Floweri, sp. n., ♂ ♀.
(Pl. IV. figs. 22–25.)

Hab. Pinang.

Type in coll Brit. Mus. Nat. Hist. (coll. S. S. Flower).

♂. Tot. len. 15·5 mm., carap. 8, ant. marg. of carap. 3; legs i. 24·5, ii. 22·5, iii. 20, iv. 28; pat.+tib. i. 8, iii. 6, iv. 8.

♀. Tot. len. 17 mm., carap. 8·5, ant. marg. of carap. 4·5; legs i. 21, ii. 20, iii. 19, iv. 26; pat.+tib. i. 7·5, iii. 5·75, iv. 7·5.

♂.—*Colour.* Mahogany-brown. Carapace with broad central band of silver-white pubescence, slightly dilate behind caput and at central stria. Marginal line of white pubescence very fine. Abdomen with broad central dorsal band of white pubescence, deeply dentate on each side behind the middle, narrowing to spinners. Ventral surface unicolorous dark brown. Lateral area with a few scattered minute white spots.

Legs paler brown, indistinctly annulate with grey. Coxæ clothed with white pubescence above. Tibiæ i. and ii. clothed above on apical two thirds with very conspicuous white pubescence, less conspicuous on iii. and iv.

♂.—*Structure.* General characters similar to those of *Thorellii* and the female (see below). Carapace convex-horizontal above, *not* gibbous behind.

Pedipalp. Tibia short, twice as long as broad (excluding process), bearing on outer side a broad process whose base extends the whole length of the segment, concave beneath, narrowed and curving forwards at apex, terminating in a broad point having a minute notch on the outer side. Seen from the outside the apex appears rounded and convex. *Tarsus* scarcely twice as long as broad. Palpal organs large, occupying total width and three fourths the length of tarsus. Central lobe very long, nearly four times as long as broad, straight, compressed-cylindrical, attenuate in middle, broader and broadly rounded at apex, slightly inclining outwards. *Unca* small, crossing beneath apex of central lobe.

* Half a dozen males and the same number of females of this species have just come before me from Ceylon. They were kindly submitted to me by the Rev. O. P. Cambridge, and were taken many years ago by Mr. Thwaites.

♀.—*Colour.* Similar to that of male, but pubescence rufous grey, not silvery white. Legs annulated and freckled with grey spots; tibiæ without conspicuous silver-grey bands. Ventral area unicolorous.

Structure. General characters similar to those of *Thorellii* ♀. Eyes: second row straight by anterior margins. Central posteriors $\frac{1}{3}$ of a diameter apart, the same distance from lateral anteriors. Ocular quadrangle broader behind, broader than long; anterior centrals $\frac{1}{4}$ smaller than posterior centrals, $\frac{1}{2}$ diameter apart, $\frac{1}{2}$ diameter from anterior margin of clypeus.

Carapace uniformly convex-horizontal in profile.

Vulva longer than broad, with narrow longitudinal central area, broadly dilate posteriorly, again narrowed and broadly truncate, curving below, clothed with short hairs. Margins coriaceous, black, dilate just before middle, emarginate and slightly dilate again, attenuate and disappearing beneath posterior portion of central area. On each side of posterior margin lies a stout denticle, its apex extending slightly beyond posterior margin of central area.

A male and female of this fine species were taken by S. S. Flower, Esq., in the island of Pinang. It resembles *Hosei* in the male sex by the conspicuous white bands on tibiæ i. and ii., but the anterior legs are shorter and protarsus i. is scarcely shorter than tibia i.; in *Hosei* it is much shorter.

Ctenus philippinensis, sp. n., ♀. (Pl. IV. fig. 1.)

Type in coll. Brit. Mus. Nat. Hist., London.

Hab. Manila, Luzon, Philippine Islands (coll. Cuming).

♀. Tot. len. 20 mm., carap. 9, ant. marg. 4; pat.+tib. i. 9, iii. 6·75, iv. 8·5.

Structure. Ocular quadrangle broader than long, broader behind; posterior eyes slightly larger than anterior, $\frac{2}{3}$ of a diameter apart; second row procurved; straight line touching anterior margin of posterior centrals cuts centres of lateral anteriors, the latter one transverse diameter from posterior centrals. Carapace convex-horizontal, not gibbous behind, obliquely inclined to base. Spinulation similar to that of others of the genus. Pat. i. and ii. without lateral spines.

Colour. Carapace mahogany-brown, clothed uniformly with golden-red pubescence; no distinct central or marginal bands. Abdomen unicolorous ferruginous.

Vulva consists of a long, transversely rugulose, narrow central prominence at base, having on each side extending posteriorly a long, oval, convex tubercle, united behind by a broad triangular plane piece. On each side of this posterior

marginal portion lies a short, rather slender tooth, its apex directed inwards (Pl. IV. fig. 1).

A single female from the Museum collection, taken by Dr. Cuming at Manila, Philippines.

(iv.) *Genera and Species of* 3-*clawed Forms, with Notes on Types and Descriptions of New Species.*

1858–59. *Dolomedes*, Walck., Dolesch. Verhand. nat. Ver. Ned. Ind. v. p. 9.

1884. *Titurius*, Sim. Ann. Mus. Genov. xx. p. 328. (Type *T. fimbriatus* (Walck.), ♀.—Cape of Good Hope, S. Africa.)

1885. *Thalassius*, Sim. Bull. Soc. Zool. Fr. p. 13. (For *Titurius*, nom. præocc.)

1891. *Dolopœus*, Thor. Kongl. Sv. Vet.-Akad. Handl. xxiv. (2) p. 60. (Type *D. cinctus*, Thor., ♀.—Isl. Kamorta, Nicobar, Bay of Bengal.)

Of the type of *Thalassius*, Sim., I know nothing, but I have been able to examine a specimen from South Africa (Umfali River) which undoubtedly belongs to this genus. The type of a species named *Thalassius unicolor* by Simon himself, from Sheik Husein, is also before me, so that one can speak without hesitation on the characters of *Thalassius*, Sim.

The species described below as *Doleschallii* and *Simoni* from Borneo are undoubtedly congeneric with *Thalassius unicolor*, Sim. Three immature forms from Tenasserim and Tharrawaddy, Burmah (e coll. Oates), referred by Thorell to *Thalassius albocinctus* (Doles.), are identical with the form to which I have given the name *Doleschallii*. I cannot regard it at present as possible to tell what form Doleschall's *albocinctus* may have been. It is not at all likely that there is only one form with broad yellow-white bands found in Java, Borneo, and Burmah. I should fully expect four or five closely allied forms to be found on a more extended search. Then it might be possible to identify *albocinctus* as that form which is found in Java exclusively, though even then there might be in this island itself two or three forms similar in general characters, differing only in the form of the vulva; and in this case the identity of *albocinctus* would be next to impossible to settle. I am confident that the absence of figures of these important structural points will in future render a great deal of descriptive work almost useless.

In the form described as *T. Simoni* the anterior central eyes are distinctly larger than the posterior centrals, and the clypeus is lower in proportion; but none the less I am

satisfied that one cannot restore Thorell's genus *Dolopœus* for the Eastern Asiatic forms, as I had at first hoped. Thorell himself regards *Dolopœus* as a synonym of *Thalassius*.

Genus Thalassius, E. Sim., 1885.

Diagnosis.—Legs 4, 2, 1, 3, or 4 (2, 1) 3. Tarsal claws 3. Superiors long, armed beneath with 9 long denticles, inferior claw with one or two minute teeth. Sternum as broad as long, circular, emarginate opposite coxæ and pointed behind. Labium longer than broad, more than half the length of maxillæ. Maxillæ attenuate at base, enlarged at apex. Lower margin of fang-groove with 3 stout teeth, superior margin with 2. A single small tooth lies on the floor of the fang-groove near lower margin nearly opposite the third tooth. Eyes in three rows (or four if one separates those of the posterior row)—2, 2, 4. Ocular quadrangle as broad as long or slightly longer than broad, broader in front, narrower behind. Anterior centrals larger (one fourth) than posterior centrals or subequal, half a diameter apart; posterior centrals $\frac{3}{4}$ diameter apart. Lateral anteriors smaller (half) than anterior centrals, $\frac{2}{3}$ a diameter from the latter, rather more from posterior centrals, 1 diameter from posterior laterals. Eyes of posterior row subequal; centrals nearer together, forming a slightly recurving line. Lateral posteriors 1 diameter from central posteriors. Clypeus equal to length of ocular quadrangle, sometimes more. Femora with numerous spines. Patellæ i., ii., iii., iv. with two lateral basal and one central apical spine. Tibiæ i. and ii. with 2—2—2—2 spines beneath, last pair apical; 1—1 lateral spines on each side in apical half, 1—1 dorsal spines basal and apical. Protarsi i. and ii. 2—2—2—2 ventral and 1 central apical spine, 2—2 lateral spines in basal half. Tibiæ and protarsi iii. and iv. somewhat similarly but more irregularly spinulate.

No true scopula beneath protarsi or tarsi, but a band of setæ and fine short hairs mingled.

A single palpal claw with 3–4 short blunt denticles.

Thalassius Simoni, sp. n., ♀ ad.
(Pl. IV. figs. 18, 21.)

Type in coll. Brit. Mus. Nat. Hist.

Hab. Borneo.

♀ ad.—Tot. len. 23 mm., carap. 10·5 × 8·75; legs i. 56, ii. 58·5, iii. 53, iv. 60; pat. + tib. i. and ii. equal 19·5, iii. 17, iv. 19·5; prot. i. and ii. 12·5, iii. 12·5, iv. 15·5.

♀.—*Colour*. Carapace dull mahogany-brown, with broad lateral marginal pale band, their inner margins subparallel, extending from exterior angles of clypeus to the base. Abdomen dark olive-brown above, with broad marginal pale yellow band extending from anterior shoulders to spinners. Unicolorous beneath. Mandibles unicolorous brown. Legs and palpi pale ochreous. Tibiæ, protarsi, and tarsi clothed with fine lateral barbules (curving hairs, such as are found on the feathers of young birds). Protarsi and tarsi clothed with dull yellow-white pubescence above, more conspicuous than on other segments.

Structure as in generic diagnosis.

Vulva broader than long (Pl. IV. fig. 18).

A single female in the Natural History Museum from Borneo.

Thalassius Doleschallii, sp. n., ♀ ad.
(Pl. IV. fig. 19.)

Type in coll. Brit. Mus. Nat. Hist.

Hab. Borneo.

♀ ad.—Tot. len. 20·5 mm., carap. 7·5×6·5; legs i. 40, ii. 40, iii. 36·5, iv. 41·5; pat.+tib. i. and ii. 13, iii. 11·5, iv. 13·5; prot. i. and ii. 8·5, iii. 8, iv. 9·75.

♀.—*Colour* precisely the same as in the last species, but the colour of the dorsal area between the white lateral bands is rich chocolate-brown and the legs are shorter in proportion to the trunk.

Structure as in generic diagnosis.

Vulva longer than broad (Pl. IV. fig. 19).

A single female in the Natural History Museum from Borneo.

The two species may be determined by the following table:—

A. Size larger, 23 mm., carapace 10·5, leg iv. 60. Central anterior eyes distinctly larger than central posteriors. Vulva broader than long. Basal disk oval-oblong, with transverse fold near posterior margin ..... *T. Simoni*, sp. n.

B. Size smaller, 20·5 mm., carapace 7·5, leg iv. 41·5. Central anterior eyes equal to central posteriors. Vulva longer than broad. Basal disk triangular, without any transverse fold ..... *T. Doleschallii*, sp. n.

Species assigned to Thalassius, *Sim.*

1885. *Thalassius marginellus*, Sim. Spec. juv. Bull. Soc. Zool. Fr. x. p. 13.

M. Simon notes an immature example of the genus *Thalas-*

sius, probably different from *T. marginellus*, Sim., found at Wagra-Karoor, Bellary, India.

1893. *Thalassius spathularis* (van Hass.), Sim. Ann. Mus. Gen. 1893, p. 327.

Of this genus Simon says (*loc. cit.*) :—"Il est remplacé dans l'Amérique du sud par le genre *Ancylometes*, Bertk." (Type *vulpes*, Bertk.)

1895. *Thalassius albocinctus* (Dol.), Thor. ♀ s juv. Tenasserim ('Spiders of Burma,' p. 227) and Tharrawaddy (*Oates*).

Legs i. 42 mm., ii. 44, iii. 38, iv. 43; pat.+tib. iv. 15.

"Gen. *Dolopœus*, Thor., non a *Thalassio* differt" (Spid. Burm. p. 228).

Thorell regards *Titurius marginellus*, Sim., as a synonym of this species.

Species described under Titurius, *Sim.*

1884. *Titurius marginellus*, Sim. ♂ juv., ♀ juv., 16 mm. Ann. Mus. Genov. xx. p. 328. Bankok, Indo-China, ♀; Burmah, ♂.

"Cephalothorax — vittis duabus albo argenteis angustis rectis a margine sat longe remotis ornatus. Abdomen—vittis albis duabus longitudinaliter marginatum."

There can be no real certainty as to the identity of this form, seeing that the species is based on an immature female.

Species described under Dolopœus, *Thor.*

1891. *Dolopœus cinctus*, Thor. ♀ ad., 16½ mm. Kongl. Sv. Vet.-Akad. Handl. xxiv. (2) p. 60. Kamorta, Nicobar Islands, Bay of Bengal.

"Ceph. ferrugineo-fusco, fascia lata alba in lateribus cincto; pedibus pallide testaceo-fuscis; abdomine secundum medium dorsi latissime cinereo-fusco vel ferrugineo, lateribus etiam dorsi albis."

Tot. len. 16·5 mm., carap. 7·75×6·75, ant. marg. 3·25; abd. 9×5; legs i. 36, ii. 36·25, iii. 32, iv. 37·25; pat.+tib. iv. 12·5.

"Area vulvæ sat magna, ex callis duobus nitidis fuscis, postice crassis et hic parallelis et inter se contingentibus, dein sensim angustioribus et humilioribus constat, qui paullo ante basin cito foras fracti et divaricantes sunt, præterea vero incurvi et foveam magnam sat profundam, rotundatam et transversam includentes.

"Tib. i. 2.2.2 aculei longi et præterea apice 2, breves absunt

antice et postice 1.1 aculei, supra aculeus 1. Met. ant. 2.2.2.2 (apicales duos breves) et utrinque 1.1 aculeos ostendunt. Unguiculi superiores . . . . dentibus . . . . (7–8) sat longis pectinati, &c.

"Oculi medii pæne in quadratum vel in rectangulum parum longiorem quam latiorem dispositi sunt; spatia inter medios anticos, ut inter medios posticos, eorum diametrum paullo superant. Spatia inter medios anticos et posticos horum diametrum pæne æquant, etc.

"Mandibularum sulcus unguicularis in margine inferiore serie dentium fortium 3 armatus."

Legs iv., ii., i., iii.

"Area oculorum pæne lunata [both series recurved]. Oculi laterales antici reliquis oculis magnis multo minores sed, ut ii, rotundi, non multo longius ab oculis mediis posticis quam a mediis anticis distant. Oculi medii fere in quadratum dispositi sunt.

"Sternum non longius quam latius.

"Spatium inter marginem clypei et oculos medios anticos horum oculorum diametro plus duplo, pæne triplo majus est.

"Oculi laterales postici magni, mediis posticis (qui mediis anticis paullulo minores sunt) non parum majores."

This form is undoubtedly congeneric with *Thalassius unicolor*, Sim., and, so far as one can gather from the description of the vulva, it is distinct from *T. Doleschallii*, sp. n.

Species described under Dolomedes, *Latr.*, 1804.

1858–59. *Dolomedes albocinctus*, Doles. ♀, 11‴. Verhandlungen der nat. Ver. Ned. Indie, v. p. 9, pl. xv. fig. 4. Java.

"Fuscus, thorace abdomineque late albo marginatis, hoc ovato-elongato; pedibus pallide testaceis, nigro setosis. Long. 11‴."

1882. *Dolomedes spathularis*, van Hass. Midden Sumatra, Arach. p. 44.

Having no species of these groups from any countries south and east of Wallace's Line, I regret that I am unable to give more than a list of forms already described from those regions.

(v.) *Bibliography relating to Cteniform Spiders from New Guinea, Australia, New Zealand, &c., South and East of Wallace's Line.*

1847.—Walckenaer. Insectes: Aptères, t. iv. p. 402, Suppl.
1875.—L. Koch. Arach. Austr. ii. p. 990, &c.
1878.—Karsch. Gieb. Zeitschrift Natur. iii. p. 825.

1880.—Eugène Simon. Bull. Soc. Ent. Belg. p. clxxiv.
1881.—Eugène Simon. Bull. Soc. Zool. Fr. p. 13, &c.
1881.—T. Thorell. Ann. Mus. Genov. xviii. p. 386, &c.
1889.—A. R. Urquhart. Trans. New Zealand Inst. xxii. p. 237, &c.
1889.—Zozen. Trans. New Zealand Inst. xxii. p. 267.
1890.—T. Thorell. Ann. Mus. Genov. p 133, &c.
1890.—A. R. Urquhart. Trans. New Zealand Inst. xxiii. p. 183.
1891-92.—T. Thorell. Ann. Mus. Genov. xxxi.

List of Ctenform Spiders from Australia, South and East of Wallace's Line.

i. *Two-clawed Forms*:

1847. *Ctenus marginatus*, Wlk. ♀, 9 lines. Ins. Apt. iv. p. 402, Suppl. —Solomon Islands.
1875. *Leptoctenus agalenoides*, L. K. ♂. Arach. Austr. ii. p. 994, t. lxxxvi. 1, 1 *a*.—Gayndah, Australia.
1881. *Leptoctenus agraeoides*, Thor. ♀ ad., 7 mm. Ann. Mus. Genov. xviii. p. 386.—Cape York, Australia.
1875. *Argoctenus igneus*, L. K. ♀. Arach. Austr. ii. p. 990, t. lxxxvi. 4, 4 *a*.—King George's Sound, Australia.
1875. *Argoctenus pictus*, L. K. Arach. Austr. ii. p. 992, t. lxxxvi. 5, 5 *a*, 5 *b*, 5 *c*.—Sydney, Australia.
1878. *Enygma australiana*, Karsch, Zeit. ges. Natur. iii. (3) p. 825.—N. S. Wales.
1880. *Ctenophthalmus lineatus*, Sim. Ann. Soc. Ent. Belg. Bull. p. clxxiv. —Noumea, New Caledonia.
1891. *Ctenomma*, Thor. Ann. Mus. Genov. vol. xi. p. 131.

ii. *Three-clawed Forms*:

1878? *Cycloctenus flaviceps*, L. K. ♀. Arach. Austr. ii. p. 988, t. lxxxvi. 3.—New Holland.
1889. *Cycloctenus abyssinus*, Urq. Trans. New Zealand Inst. xxii. p. 237, pl. xvi. 1.—Janola Caves, N. S. Wales.
1889. *Cycloctenus lepidus*, Urq. Trans. New Zealand Inst. xxii. p. 261, pl. xvi.—Wellington, New Zealand.
1889. *Cycloctenus fujax*, Zozen, Trans. New Zealand Inst. xxii. p. 267.—New Zealand.
1890. *Cycloctenus pulcher*, Urq. Trans. New Zealand Inst. xxiii. p. 183.—New Zealand.
1875. *Pycnoctenus robustus*, L. K. ♀. Arach. Austr. ii. p. 996, t. lxxxvii. 2.—Sydney.

EXPLANATION OF PLATE IV.

Fig. 1. *Ctenus philippinensis*, sp. n. ♀. Vulva.
Fig. 2. —— *Thorellii*, sp. n. ♂. Left palpus from beneath
Fig. 3. —— *sarawakensis*, sp. n. ♀. Vulva.
Fig. 4. —— *denticulatus*, Sim. ♂. Palpal bulb from below.
Fig. 5. —— ——. ♂. Tibia of right pedipalp from outside.
Fig. 6. —— ——. ♂. Apex of tibia enlarged.
Fig. 7. —— ——. ♂. Eyes from in front.
Fig. 8. —— ——. ♀. Vulva.
Fig. 9. —— ——. ♀. Maxillæ and labium.
Fig. 10. —— *sarawakensis*, var. ♀. Vulva.

Fig. 11. *Ctenus Hosei*, sp. n. Vulva.
Fig. 12. —— *ceylonensis*, sp. n. ♀. Vulva.
Fig. 13. —— *trabifer*, Thor. (Karsch). ♀. Vulva, after Karsch.
Fig. 14. —— ——, Thor. ♀. Vulva, from type.
Fig. 15. —— *Thorellii*, sp. n. ♀. Vulva.
Fig. 16. —— *valvularis*, van Hass. ♀. Vulva, after van Hasselt.
Fig. 17. —— *Hosei*, sp. n. ♀. Vulva, var.
Fig. 18. *Thalassius Simoni*, sp. n. ♀. Vulva.
Fig. 19. —— *Doleschallii*, sp. n. ♀. Vulva.
Fig. 20. *Ctenus Hosei*, sp. n. ♀. Vulva, var.
Fig. 21. *Thalassius Simoni*, sp. n. ♀. Tarsal claws.
Fig. 22. *Ctenus Floweri*, sp. n. ♂. Tibia of left palpus from outside.
Fig. 23. —— ——. ♀. Vulva.
Fig. 24. —— ——. ♂. Tibia of left palpus from beneath.
Fig. 25. —— ——. ♂. Palpal bulb and organs from beneath.
Fig. 26. —— *ceylonensis*, sp. n. ♂. Palpal bulb and apex of tibia of left palpus from beneath.
Fig. 27. —— *Thorellii*, sp. n. ♂. Left palpal bulb from beneath.
Fig. 28. —— *Hosei*, sp. n. ♂. Left palpal bulb from below. *b*. Apex of basal dorsal spur.
Fig. 29. —— ——. Left palpus from outside, showing base of tarsus and dorsal basal spur.
Fig. 30. —— ——. Tibia of pedipalp from beneath and base of tarsus, with dorsal basal spur.

XXXVIII.—*On new Species of* Histeridæ, *and Notices of others.* By G. Lewis, F.L.S.

List of Species.

Apobletes servulus.
Platysoma extrarium.
Pachycrærus morulus.
Hister Colensoi.
—— planiformis.
Stictostix mormoni.
Phelister hilarulus.
Anaglymma impar, *Mars.*
Trypeticus planisternus.
—— incilis.
—— mustelinus.
Pygocœlis africanus, *Lew.*
Trypobius, spp.

Apobletes servulus, sp. n.

Oblongus, leviter convexus, rufo-brunneus, nitidus; fronte dense punctata, stria integra, antice impressa; elytris striis 1–4 integris, 5 basi abbreviata, suturali apicali dimidiata, humerali interna integris, interstitiis punctulatis; pygidio punctato, margine extus elevato.
L. 3 mill.

Oblong, slightly convex, reddish brown, shining; the head anteriorly impressed and angularly projecting before the eyes, densely punctured, punctures irregular, some (especially on the vertex) large and ocellate, but mixed with small

points, other large punctures behind the transverse striæ are confluent, transverse stria straight and well marked; the thorax, marginal stria complete and raised laterally, punctulate on the disk, but outside the central area the points are larger and clearer, somewhat dense, with a few fine points interspersed, along the base is an irregular line of the larger points; the elytra—striæ, outer humeral dimidiate, internal complete and very similar to the first stria, 1–4 complete, 5 abbreviated before the base, sutural apical and dimidiate, interstices finely punctulate, with a band of larger points along the posterior margin; the propygidium closely, not densely punctured, with the posterior margin feebly raised; the pygidium, punctures larger and deeper than those of the propygidium, and the external rim is manifestly elevated; the prosternum without striæ, keel feebly punctulate, anterior lobe distinctly punctate; the mesosternum sparsely punctulate, widely, not deeply emarginate, stria complete but ends at the metasternal suture; the anterior tibiæ 4-dentate.

The dense surface-sculpture of the forehead gives a similar appearance of opacity to that seen in *A. Schaumi*, Mars., but there the similarity ends.

Hab. Cameroon.

Platysoma extrarium, sp. n.

Oblongum, subcylindricum, nigrum, nitidum; fronte punctulata, stria integra tenuiter impressa: thorace stria integra necnon basi conspicue continuata; elytris striis 1–4 integris, 5 apicali dimidiata; pygidio basi punctata, apice lævi.

L. 7 mill.

Oblong, somewhat cylindrical, black, shining; the head anteriorly impressed, surface finely punctulate, stria complete but very fine anteriorly, where it crosses the impressed area; the thorax, anterior angles somewhat produced, surface microscopically punctulate, lateral rim carinate and joins the lateral stria behind the eyes, lateral stria complete anteriorly and posteriorly, before the scutellum there is a distinct oval fovea in front of the basal line; the elytra at their bases have a corresponding stria to the basal thoracic one, but it is not quite so deep and it is carried along the lateral border of the elytra as an inner epipleural stria, there is a fine oblique basal humeral line, striæ 1–4 are complete with crenulate edges, 5 apical and dimidiate, sutural wanting; the propygidium is irregularly punctured, punctures for the most part not circular in outline, the basal margin and a small triangular median basal space smooth; the pygidium is punctured at

its base like the propygidium and the apex is smooth; the prosternum, anterior lobe very large, keel narrow between the coxæ, with a loop-shaped stria, which joins behind; the mesosternum is widely emarginate, stria complete and is close to the anterior edge; the metasternum is longitudinally canaliculate in the middle; the anterior tibiæ are 4-dentate and somewhat dilated.

The size and form of this remarkable species is similar to *Pachycrærus viridis*, Mars. *Platysoma canalicolle*, Mars., has a stria which entirely surrounds the thoracic margin, but it is not so deep and conspicuous as in *P. extrarium*.

Hab. Queensland, Australia.

Pachycrærus morulus, sp. n.

Oblongus, parum ellipticus, subcylindricus, picco-niger, nitidus; antennis pedibusque rufo-brunneis; capite punctulato, stria antice integra; elytris, striis subhumerali externa, 1–4 suturalique integris, 5 basi abbreviata vel evanescenti; prosterno bistriato; mesosterno antice haud striato.

L. $3\frac{3}{4}$ mill.

Oblong, somewhat elliptical and cylindrical, nearly black, with the antennæ and legs reddish brown; the head impressed anteriorly, stria complete and anteriorly straight, surface evenly punctulate; the thorax wider than broad, surface clearly punctured, punctures varying in size, with a very fine punctuation between the larger points, lateral margins are narrowly free of punctures, the lateral marginal stria continues as a very fine stria behind the eye, but it is interrupted behind the middle of the neck; the elytra—striæ, external subhumeral fine and complete and at the apex turns inwards and terminates at a point behind the second stria, internal fine, basal, and oblique, 1–4 complete, 5 abbreviated at the base or just visible in certain lights, sutural almost complete, arrested at a point level with the scutellum; the propygidium and pygidium clearly punctured, punctures are somewhat irregular and leave the pygidium smooth at its apex; the prosternum is narrow, bistriate, striæ not meeting anteriorly, are nearly parallel at the sides, and widen out slightly between the coxæ; the metasternum is very feebly bisinuous on either side of the acumination, which is small and obtuse; the meso- and metasterna have each a distinct lateral stria and the first segment of the abdomen has two fine lateral striæ on either side; the anterior tibiæ have three large teeth in the middle and smaller ones outside of them.

The elliptical subcylindrical form of this species is unlike

any other described, but the prosternal (except that they do not meet in front) and mesosternal striæ resemble those of *P. cyanipennis*, Fähr.

Hab. Zanzibar (*Raffray*).

Note.—*Pachycrærus Bocandei*, Mars., *P. cyaneipennis*, Fähr., *P. morulus*, Lew., and *P. frater*, Lew., form a small group in the genus in which the mesosternum has no marginal stria on the anterior border: *P. Bocandei*, Mars., is known from the others by having the thoracic stria complete; in *P. cyaneipennis*, *morulus*, and *frater* the stria is interrupted behind the neck; in *P. frater* the fifth dorsal stria is sometimes evanescent before the base.

Hister Colensoi, sp. n.

Breviter ovatus, convexus, niger, nitidus; fronte minute punctulata, stria antice recta; pronoto bistriato, striis parallelis, margine ciliato; elytris striis 1–3 integris, 4–5 apicali-punctiformibus, suturali antice late abbreviata; prosterno in medio angustato haud striato.

L. 8½ mill.

Shortly oval, convex, black, shining; the head very minutely punctulate, stria complete, straight anteriorly, vertex smooth; the thorax, outer margins ciliate, lateral rim very finely carinate and continued as a stria behind the head, but is widely interrupted behind the neck, outer lateral stria runs parallel to the margin, has a narrow interstice, and ceases after passing the anterior angle, inner stria complete and parallel to the outer one, interstice wide save in front; the elytra, outer humeral stria absent, inner deep and shortened before the base, 1–3 complete, 4–5 represented by a few very fine apical points, sutural dorsal turning from the suture apically; the propygidium and pygidium punctate, but the points are not closely set, apical edge of the latter smooth; the prosternum, keel before the coxæ narrow, without striæ; the mesosternum is feebly sinuous, stria complete, also sinuous and close to the anterior edge; the anterior tibiæ strongly tridentate, the others spinose.

The species should be placed next to *H. robusticollis*, Lew. It belongs to Marseul's first division.

Hab. Ulundi, Natal (*Marshall*). A stercoraceous species (no. 428).

Hister planiformis, sp. n.

Ovalis, parum convexus, niger, nitidus; fronte impressa, stria integra; pronoto stria laterali interna haud interrupta, externa

ante medium abbreviata; elytris striis 1–2 integris, 3 late interrupta, 4–5 apicalibus brevissimis, suturali basi late, apice minime abbreviata; pygidio utrinque subfoveolato.
L. $5\frac{3}{4}$ mill.

Oval, somewhat convex, black, shining; the head, forehead impressed, stria complete and semicircular, surface sparsely and microscopically punctured; the thorax—striæ, internal complete and laterally sinuous in the middle, fine and obscurely crenulate behind the head, external short, not reaching the middle; the elytra, subhumeral stria somewhat similar to that in *H. cavifrons*, Mars., but fine and only obsoletely bifurcate, 1–2 fine and complete, 3 fine and broadly interrupted behind the middle, course indicated only by faint points, 4–5 each represented by a very short apical line, sutural anteriorly reaches the middle of the dorsum and terminates just before the apex, from its commencement it inclines a little from the suture; the propygidium is sparingly punctulate at the base and the points gradually become fine and few posteriorly, posterior edge feebly impressed; the pygidium, apex almost smooth, base and sides clearly, not closely, punctured, before the apex on either side is a distinct but shallow fovea; the prosternum is without stria; the mesosternum is sinuous anteriorly, marginal stria complete, somewhat fine and close to the edge, transverse stria also fine and apparently interrupted in the middle, both striæ are feebly crenulate; the tibiæ, anterior 6–7 dentate, intermediate and posterior spinous.

This species belongs to the *cavifrons* group; its trivial name is suggested by its dorsal striæ resembling those of a species of *Homalodes* (*planiformis*).

Hab. Grenada, Mount Gay Estate, leeward side (*H. H. Smith*, no. 228).

Stictostix mormoni, sp. n.

Ovalis, parum convexus, brunneus, nitidus; fronte concava, supra oculos elevata utrinque oblique carinata; pronoto, stria marginali anguste elevata, ante scutellum impresso; elytris striis omnibus integris, interstitiis punctulatis; antennis pedibusque concoloribus.
L. $2\frac{2}{3}$ mill.

Oval, convex above, brown, shining; the head, face slightly concave, conical over the eyes, the bases of the cones continue obliquely as ridges towards the epistoma, surface uneven and irregularly punctured; the thorax, lateral edges narrowly elevated, surface punctured irregularly, punctures

large and shallow, with very fine points intermixed, the lateral carinæ continue behind the head as an indistinct marginal stria, vague and faintly crenulate, there is a shallow antescutellar depression; the elytra, humeral and subhumeral striæ complete and cariniform, six dorsal complete, the sutural joining the fifth at the base, along the suture is a row of punctures set very regularly, which at first sight look like an inner sutural stria, the first, second, and third striæ are more or less cariniform, especially at their bases, the interstices have a lineal punctuation; the propygidium and pygidium are punctured somewhat similarly to the thorax, but are without the intermediate fine points; the prosternum irregularly punctate, striæ cariniform between the coxæ and anteriorly greatly widen out, and continue to join in front as a rim to the lobe; the mesosternum, truncate anteriorly, transverse and narrow, strongly margined at the sides, anterior marginal stria scarcely visible, sparsely punctate, transverse stria almost straight and crenulate; the metasternum and first abdominal segment also sparsely punctate; the legs and antennæ concolorous, club of the latter paler.

This species is more oval (not broadly oval) than *S. californicus*, Horn. The long basal joint of the antenna, the broad prosternum, the narrow transverse mesosternum, form of the legs, and general dorsal sculpture leave no doubt in my mind that the species is congeneric with *S. parra*, Mars., from Australia.

Hab. Utah.

Phelister hilarulus, sp. n.

Suborbicularis, convexus, niger, nitidus; fronte plana, stria semicirculari integra; pronoto lateribus distincte punctato, stria integra antice crenulata; elytris striis 1–3 integris, 4 interrupta, 5 brevi, suturali dimidiata obliqua; propygidio pygidioque aliquanto dense punctulatis; prosterno mesosternoque punctatis; tibiis anticis spinosis.

L. $2\frac{3}{4}$ mill.

Nearly orbicular in outline, convex, black, and shining; the legs and antennæ pitchy brown; the head with an extremely fine punctuation, stria well marked and semicircular in outline (a character possessed by other species of this section); the thorax, marginal stria entire, raised at the angles, feebly crenulate behind the neck; surface very finely punctulate on the disk, with larger points broadly scattered on either side, and before the scutellum is a rugose biarcuate impression; the elytra, striæ 1–3 well-marked and complete,

4 broken into points before the base, 5 short and apical, with a single point as a basal appendage, sutural stria apical and dimidiate, close to the suture at the apex, but markedly divergent in its course (like that of *P. 4-punctulus*, Mars. Mon. pl. xiv. fig. 4), internal humeral short and apical, interstices very finely punctulate on the disk, but the points increase in size towards the apex; the propygidium and pygidium are somewhat densely and finely punctured, before the apex of the latter is a transverse impression (perhaps not a permanent character); the prosternum evenly punctate, bistriate, striæ joining anteriorly and widening out behind; the mesosternum also punctate and robustly produced anteriorly, marginal stria complete, transverse stria straight, wide, and shallow, with crenulate edges; the anterior tibiæ spinous.

This species belongs to the same section of the genus as *P. circulifrons*, Mars., *breviusculus*, Mars., and *nitidus*, Lew., but it may be known at once by its oblique sutural striæ and punctured sternal plates. *P. nitidus*, Lew., is the least convex species of the three mentioned.

Hab. Cameroon.

Anaglymma impar.

Phelister impar, Mars. Bull. Soc. Ent. Fr. (6) ix. p. cxxvii (1889).

This species belongs to the genus *Anaglymma*, and it resembles *A. congonis*, Lew., in having the fifth and sutural dorsal striæ formed of single, not double lines.

Hab. Zanzibar.

Trypeticus planisternus, sp. n.

Cylindricus, brunneo-piceus, nitidus; capite vertice minute foveolato, rostro basi in medio elevato, utrinque depresso; prosterno plano haud striato; mesosterno utrinque sulcato; pygidio convexo, punctato.

L. 4 mill.

Cylindrical, pitchy brown, shining; the head with a small but distinct fovea on its vertex, a frontal ridge separates the feebly convex vertex from the face, a robust median ridge forms the base of the rostrum, with a corresponding excavation on either side of it, the apex of the rostrum is short and obtuse, with a median sulcus before the tip, region of the sulcus depressed; the thorax not closely punctured, punctures largest and closest at and near the anterior angles, with a faint longitudinal ridge behind the middle of the neck; the elytra, punctuation distinctly finer than that of the thorax;

the propygidium and pygidium are more closely and clearly punctured, the later convex above; the prosternum is about one third longer than wide, truncate at both ends, with a microscopic strigose surface-sculpture and a few very small punctures, without striæ, and the lateral edges are rounded off, not angulate; the mesosternum sulcate on either side behind the anterior coxæ, anteriorly immarginate, surface with scattered oblong punctures; the anterior tibiæ 5-dentate.

This is the only species I have seen without prosternal striæ or sulci; the female is not known to me.

Hab. Sumatra.

Trypeticus incilis, sp. n.

Cylindricus, piceo-brunneus, nitidus; capite vertice obscure punctato in medio minute foveolato, antice plano immarginato, rostro minute bituberculato; prosterno striis lateralibus antico conjunctis.

L. 3¾–4 mill.

Cylindrical, pitchy brown, shining; the head, vertex obscurely punctured, with a shallow median fovea, face nearly flat, ♂ feebly impressed in the middle, ♀ impression more distinct, more obtuse, with two very small tubercle-like projections on its anterior edge, and equally large in both sexes; the thorax with a lateral stria only, somewhat densely punctured, with a narrow smooth space in the middle, more or less defined, ♂ with a short depression behind the neck and a feeble carina along its centre, ♀ without the depression, but with dense punctures behind the neck; the elytra are more conspicuously punctured in the ♀ than ♂ and are fairly close together; the propygidium and pygidium are clearly and rather closely punctured, the latter is slightly convex and immarginate; the prosternum is about one third longer than broad, punctate, truncate before and behind, with a distinct marginal stria at the sides and which continues anteriorly; the mesosternum has a lateral sulcus only; the anterior tibiæ 5-dentate.

This species is a little smaller than the last; it has no facial marginal stria like that of the next species.

Hab. Sumatra.

Trypeticus mustelinus, sp. n.

♂. Cylindricus, piceo-brunneus, nitidus; capite antice plano, margine triangulariter carinato, rostro reflexo, subacuto; pronoto lateribus profunde sinuato; pygidio dense punctato; prosterno mesosternoque utrinque sulcatis; metasterno in medio canaliculato.

L. 3¼ mill.

Cylindrical, rather elongate, pitchy brown, shining; the head, vertex minutely strigose, with a few irregular shallow punctures and a small median fovea, face somewhat narrow, flat, and irregularly punctulate, with a marginal three-sided carina, carina straight at the base, gradually converging anteriorly, and terminating in a somewhat acute raised tip; the thorax striate laterally, margin anteriorly a little wide, but before the middle the thoracic edge is cut out somewhat abruptly at the expense of the margin; this incision or sinuosity admits of the intermediate tibiæ being moved in a narrow cylindrical gallery, and the stria now running close to the edge continues to the basal angle, surface distinctly and somewhat closely punctured, behind the neck is a short median carina, but the thorax is not impressed, anterior angles reddish; the elytra more finely and more sparsely punctured than the thorax; the propygidium and pygidium densely punctured, the latter a little convex; the prosternum laterally sulcate, sulci shortened a little anteriorly; the mesosternum rather widely sulcate on either side; the metasternum is longitudinally canaliculate, all the sternal plates are punctured; the anterior tibiæ 5-dentate.

I do not know the female.

The form of the thoracic margin noticed above is seen more or less distinctly in *Trypeticus indica*, *bombacis*, and *planisternus*, Lew., but it is not such a marked character as in *T. mustelinus*.

Hab. Sumatra.

Pygocœlis, Lewis.

In this genus I find what I believe is a sexual character; in some additional specimens I have acquired of *P. africanus*, Lew., the middle of the pygidium is concave, not the whole of the surface. It appears as though the external margins were greatly thickened.

Trypobius, Schmidt.

In the three species of the above genus noticed in the Ann. & Mag. Nat. Hist., Aug. 1897, p. 195, the sinuosities in the thoracic margin are in the reverse position to those seen in *Trypeticus mustelinus* &c. It is the anterior part of the margin which is lost in *Trypobius*, and in *Trypeticus* it is the basal portion.

This difference is doubtless of great generic importance.

XXXIX.—*Note on some Reptiles and a Frog from Argentina.*

By Dr. A. Günther, F.R.S.

I have received from Falkland Ricketts, Esq., a small collection of Reptiles which he made in Santa Fé. It contained three lizards (*Ameiva surinamensis*, *Anisolepis undulatus*, and *Lepidosternum affine*), eight snakes (*Pseudablabes Agassizii*, *Liophis pœcilogyrus*, *Xenodon rhabdocephalus* [or *X. Merremii*, Wagl.?, Boul., Peracca], *Thamnodynastes Nattereri*, *Philodryas Schotti*, *Philodryas psammophideus*, *Oxyrhopus rhombifer*, and *Lachesis alternatus*), and one frog, which I consider to be a distinct and undescribed species.

The specimen of *Anisolepis undulatus*, which species is still a desideratum to the majority of collections, is unfortunately not in a good state of preservation. The Amphisbænian is, without doubt,

Lepidosternum affine, Böttger.

I do not consider *L. Boettgeri*, Boul. Lizards, ii. p. 466, from Corrientes, to be distinct from Böttger's species, and probably both are identical with Strauch's *L. Güntheri*.

The specimen in Mr. Ricketts's collection is of nearly the same size as the type of *L. Boettgeri*. It has 254 annuli of the body and 14 of the tail; an annulus contains 30 dorsal and 26 ventral segments. There are 6 well-formed præanal segments, with a minute rudimentary one on each side. In *L. Boettgeri* I count 7, 3 on one and 4 on the other side. Also the shape and arrangement of the parietal and occipital shields seem subject to abnormal asymmetry and individual variation. In our specimen they are more symmetrical than in the type of *L. Boettgeri*, the parietal being broader than long (one more so than the other) and the occipital not quite twice as broad as long.

I dedicate the new tree-frog to the collector, naming it

Phyllomedusa Rickettsii, sp. n.

Parotoids large, rather longer than the head, commencing from above the middle of the eye and forming an elongate prominent pad on each side of the head and neck. Upper and lateral parts, also the upperside of the thighs, covered with rather large tubercles, the remainder of the hind leg, the fore limb, and head being smooth. Lower parts coarsely granular, the largest granules are enclosed within the yellow patches about to be described.

Snout slightly longer than the eye, with distinct canthus rostralis and sloping high sides; tympanum half the size of the eye; interorbital space much broader than the upper eyelid. Tongue with a shallow emargination behind. Vomerine teeth in two short transverse series between the choanæ.

Fingers free, the first shorter than the second, the fourth nearly as long as the third; toes free, the first longer than the second, the fifth much longer than the third. Fingers and toes but slightly swollen at the tip. The length of the body equals the distance of the vent from the metatarsal joint. No metatarsal tubercle.

Upper parts green (bluish in spirit); throat and chest bluish, with a yellow Y-like marking in the middle and other yellow symmetrical markings on the sides; the largest of the granules are within these markings. Lower eyelid with a small yellow spot in front and behind. Lower jaw with a yellow margin, continued as a narrow glandular band to the middle of the length of the body. A yellow spot in each groin and several others round the vent and on the lower side of the thighs. No sharply defined white line along the outer side of the forearm and tarsus.

Length of body 68 millim.

Distance of vent from extremity of longest toe 95 millim.

This species seems to have been seen already by Dr. C. Berg, who refers two *tuberculated* specimens from the Prov. Missiones to *Ph. Burmeisteri* (An. Mus. Nac. Buenos Aires, v. 1896, p. 212); indeed, the two species are closely allied. But after a comparison of our specimen with the types of *Ph. Burmeisteri*, I cannot hesitate to regard the differences in the structure of the skin, in the coloration, and in the form of the head as characters of specific value.

XL.—*Descriptions of six Pierine Butterflies of the Genus* Catasticta *in the Collection of the British Museum.* By Arthur G. Butler, Ph.D. &c.

The following undescribed species were mostly collected by the late Mr. Buckley in Ecuador, and were confounded by Hewitson (who unfortunately destroyed the labels recording their exact habitats) with well-known species.

1. *Catasticta vapina*, sp. n.

Nearest to *C. pinava*, which it nearly resembles on the

upper surface; all the pale markings are, however, clearer, more sandy yellowish, excepting those on the outer margin, which are white; those towards the base are extended in a diffused manner towards the base; the spots crossing the disk of secondaries are acutely hastate, diffused externally. On the under surface the colouring and pattern more nearly approach those of *C. philothea*, but all the light areas are wider and more sharply defined; the general colouring of the primaries is clear buff, that of the secondaries pearl-white, washed with sulphur-yellow on the inner half of the discal and marginal white markings, and here and there over the basal area much as in the secondaries of *C. manco*; the apical area and marginal spots of the primaries are also similarly tinted.

Expanse of wings 46–52 millim.

Ecuador (*Buckley*). Two males, coll. Hewitson.

From all its near allies this species may be distinguished by its clearer brighter colouring both above and below, by the sharp definition of the under-surface markings, by the much wider and less crescent-shaped disco-submarginal spots across the under surface of the primaries and the wider corresponding belt of markings across the secondaries. Hewitson confounded this species with *C. modesta*.

2. *Catasticta cinerea*, sp. n.

Primaries above ash-grey, with the veins and costal margin broadly black; outer fourth of the wings occupied by a broad black border, crossed by a series of whitish-grey spots; a marginal series of minute white dots: secondaries with the basal half ash-grey irrorated with black; outer half black, crossed by a series of whitish-grey spots; a marginal series of small sulphur-yellow spots. Body blackish; palpi with two lateral white lines; collar with a small yellow spot on each side. Under surface nearly resembling that of *C. uricæchcæ*, but the grey areas more slate-coloured, the yellow markings deeper in tint, all the pale markings more sharply defined and those crossing the primaries broader.

Expanse of wings 65 millim.

Locality unfortunately not preserved. One male, coll. Hewitson.

This very fine species and the two following were confounded by Hewitson with *C. uricæcheæ*; the present species is, however, in some respects nearer to *C. semiramis* and *amastris*.

3. *Catasticta vulnerata*, sp. n.

Allied to *C. uricæcheæ*, but easily distinguished by the fact that on the upper surface the basal area of the primaries as well as of the secondaries is suffused with crimson, the discal white spots narrower, the crimson on the secondaries more restricted and greyer, the spots of the discal series small, paler red, and diffused, the marginal internervular spots whitish. On the under surface the markings are more sharply defined, the yellow markings brighter, the grey discal belt across the secondaries with nearly straight inner edge, and therefore broader, the white and yellow belt bounding it internally consequently narrower; the marginal spots broader, slightly less angular.

Expanse of wings 58–61 millim.

Ecuador (*Buckley*). Three males.

4. *Catasticta tricolor*, sp. n.

Also allied to *C. uricæcheæ*, but with all the spots on the upper surface of the primaries bright lemon-yellow; the scarlet markings on the secondaries less brilliant in colour, the patch towards the base more restricted, the spot within the end of the cell diffused inwardly and those across the disk much elongated; a marginal series of yellow spots. On the under surface the white and yellow markings are so much reduced in size as to give this species a decidedly greyer aspect, in which respect it somewhat approaches *C. cinerea*; it, however, appears to differ from all its allies in having the base of the abdominal fold of the secondaries bordered with scarlet.

Expanse of wings 63 millim.

Ecuador. One fine male example.

In the Hewitson collection under the name of *C. sisamnus* are two males of what I believe to be a very distinct species allied to both *C. hegemon* and *C. fliza*. Unfortunately the habitat of the species has not been preserved, and as this group is somewhat more variable than others in the genus and the species more difficult to describe so as to be easily recognizable, I prefer to leave it unnamed until specimens come to hand with information as to habitat.

The following species was confounded with his *C. anaitis* by Hewitson:—

5. *Catasticta sordida*, sp. n.

♂. Above with the general colouring of *C. anaitis*, but

slightly more yellow; the spot in the cell and those of the discal series of the primaries nearest to the costa decidedly smaller: secondaries with the external blackish border occupying nearly half the wing and crossed by large well-defined spots of the ground-colour; a marginal series of small white spots. Below, all the pale markings are reduced and the brown areas consequently much broader; the pale bands also are cream-coloured, not pure white, and the yellow streaks and spots deeper in tint.

Expanse of wings 62–68 millim.

Bolivia. Three males.

6. *Catasticta Staudingeri*, sp. n.

Allied to *C. corcyra*, with which it has been confounded; it differs above in the restriction of the black apical patch of the primaries, which becomes linear from the second median nervule; on the under surface the apical border is broadly bright yellow and traversed by two grey lunular markings; the secondaries are bright yellow, the veins black, with white borders; in the markings of these wings it differs from *C. corcyra* in having the irregular postmedian stripe placed a little nearer the outer margin and in having a well-defined boldly zigzagged submarginal brown line, the outer angles of which terminate on the margin at the extremities of the nervures.

Expanse of wings 54 millim.

E. Peru. One male (type), B. M.

Also five examples from Ecuador in the Hewitson collection labelled as *C. corcyra*. Of the latter we have three examples from the Ucayali River, Peru, which correspond exactly with Felder's figure.

As I have just heard that Dr. Staudinger, of Dresden, is interesting himself in the study of this genus, I have named the preceding very distinct species in honour of him.

XLI.—Cicadidæ *from the Malay Archipelago.*

By W. L. Distant.

Cicada operculissima, sp. n.

Head ochraceous; two spots on front and a broad fascia between the eyes black. Pronotum castaneous, its posterior and lateral margins pale ochraceous; a central fascia and

subbasal transverse streak and spot and a spot on each lateral margin black. Mesonotum very dark castaneous; lateral and posterior margins and basal cruciform elevation pale greenish ochraceous; disk with two large obconical central dark ochraceous fasciæ. Abdomen very dark castaneous, posterior segmental margins pale greenish ochraceous, two small central white spots at base, and a large white spot on each lateral margin of the second segment. Body beneath pale ochraceous and greyishly pilose; legs pale castaneous, bases of the tibiæ greenish ochraceous; face centrally pale greenish ochraceous, the transverse ridges black; opercula greyish white, with their disks ochraceous; two large black spots on apical segment and two smaller ones on anal appendage.

Tegmina and wings pale hyaline, the venation greenish on basal and pitchy on apical areas.

Opercula very long, about reaching base of apical segment, subtriangular, their apices obtusely rounded. Rostrum reaching the posterior coxæ.

Long., excl. tegm., ♂ 28 millim.; exp. tegm. 90 millim.

Hab. Lombok, Sambalun, 4000 feet (*H. Fruhstorfer*).

This species is allied to the one figured by Stoll (fig. 132), of which there is a female Javan specimen in the British Museum, and from which the elongated opercula and the size and markings render it very distinct.

Huechys incarnata, Germ.

Huechys incarnata, Dist. Mon. Orient. Cicad. p. 112, tab. iii. figs. 4 *a*, *b*.

Var. *b* differs from var. *a* (ibid. p. 113) as follows:—The front is red as in typical specimens; the centre of the abdomen both above and beneath (excluding the segmental margins) black. Tegmina greyish white, with the venation, basal cell, &c. black as in ordinary examples, but with the whole apical half infuscated.

S. Celebes, Bua-Kraeng, 5000 feet (*H. Fruhstorfer*).

Genus Lembeja.

In my 'Monograph of Oriental Cicadidæ,' under the specific name *Lembeja maculosa*, Dist., I included the type, a female specimen in the Dresden Museum, and a male specimen in the Genoa Museum, both from Celebes. These were the only two specimens I had then seen, and I thought it best to include them under one specific name. I have recently acquired two other female specimens, collected by Herr H.

Fruhstorfer in S. Celebes, and can now differentiate two distinct species :—

A. Tegmina pale hyaline, minutely spotted along the veins and more or less across their apical halves.	
a. Tegmina with second apical area much shorter than first, third a little longer than first.	
b. Exp. tegm., ♀ 56 millim.	*L. maculosa*. (Proc. Zool. Soc. 1883, t. xxv. figs. 3 *a*, *b*.)
B. Tegmina pale ochraceous, subhyaline, spotted along the veins, and minutely mottled over the whole area.	
aa. Tegmina with second apical area a little shorter than first, third much longer than first.	
bb. Exp. tegm., ♀ 80 millim.	*L. Fruhstorferi*, sp. n. (♂, Mon. Orient. Cicad. t. vii. figs. 13 *a*, *b*.)

The new species is to be differentiated by its larger size, darker-coloured tegmina, and by the above detailed differences in the relative lengths of their three upper apical areas. Both species were taken by Fruhstorfer in S. Celebes—*L. maculosa* at Patunuang and *L. Fruhstorferi* at Bua-Kraeng, 5000 feet.

XLII.—*A List of the Fishes obtained by Mr. J. Stanley Gardiner at Rotuma, South Pacific Ocean.* By G. A. Boulenger, F.R.S.

I have lately been engaged in naming a collection of small fishes made by Mr. J. Stanley Gardiner at Rotuma. Although all the specimens belong to known species, it may not be without interest to publish a list of them, by which our knowledge of their distribution will be increased. I have the pleasure to add that a complete set of these fishes, in an excellent state of preservation, has been presented to the British Museum by Mr. Gardiner, who has kindly furnished me with the following note on the manner in which they were obtained :—

"After the 'Coral-boring Expedition to Funafuti' returned to Fiji, I went in H.M.S. 'Penguin' to Rotuma, a small island about 260 miles N. by W. of Fiji; here I remained three and a half months. The island is about 8 miles long by 2 broad, and round it is a boat-channel with

about 3 feet of water at low tide. Here the natives regularly farm the reef by baiting heaps of stones and coral with coconut scraped up and mixed with the ink of the cuttle-fish; the fish always go to these heaps or some shelter at low tide, and are caught by nets and baskets. All the fish in the collection may be said to be typically reef-fish, and not fish merely visiting the reef with the tide. I think that the collection of these fish is a fairly complete one, as the natives, who have names for nearly all the fish, could only recall three by name which were unrepresented, and many were quite unknown to them. Some of the smaller kinds were obtained by breaking up masses of *Madreporaria*, between the branches of which they live, and to which they invariably swim for shelter."

1. *Kuhlia tæniura*, C. & V.
2. *Epinephelus merra*, Bl.
3. *Plesiops nigricans*, Rüpp.
4. *Grammistes sexlineatus*, Thunb.
5. *Apogon hypselonotus*, Blkr.
6. —— *frenatus*, Val.
7. —— *fasciatus*, White.
8. —— *savayensis*, Gthr.
9. *Gerres gigas*, Gthr.
10. *Cirrhites arcatus*, C. & V.
11. *Cirrhitichthys oxyrhynchus*, Blkr.
12. *Upeneus trifasciatus*, Lacép.
13. *Chætodon strigangulus*, Soland.
14. —— *setifer*, Bl.
15. —— *quadrimaculatus*, Gray.
16. —— *vittatus*, Schn.
17. —— *lunula*, Lacép.
18. —— *pelevensis*, Kner.
19. —— *citrinellus*, Gthr.
20. *Holacanthus cyanotis*, Gthr.
21. —— *nicobariensis*, Bl. Schn.
22. *Myripristis murdjan*, Forsk.
23. *Holocentrum diploxiphus*, Gthr.
24. —— *microstoma*, Gthr.
25. —— *erythræum*, Gthr.
26. —— *sammara*, Rüpp.
27. *Rhynchichthys brachyrhynchus*, Blkr.
28. *Acanthurus triostegus*, L.
29. —— *nigros*, Gthr.
30. —— *lineatus*, L.
31. —— *olivaceus*, Bl. Schn.

32. *Acanthurus flavescens*, Benn.
33. *Naseus unicornis*, Forsk.
34. —— *lituratus*, Forst.
35. *Zanclus cornutus*, L.
36. *Percis tetracanthus*, Lacép.
37. *Scorpæna guamensis*, Q. & G.
38. —— *dentata*, Gthr.
39. —— *nuchalis*, Gthr.
40. —— *tristis*, Klunz.
41. —— *diabolus*, C. & V.
42. *Pterois volitans*, L.
43. —— *zebra*, C. & V.
44. *Synancia verrucosa*, Bl. Schn.
45. *Antennarius nummifer*, Cuv.
46. *Gobius albopunctatus*, Cuv.
47. —— *neophytus*, Gthr.
48. *Gobiodon rivulatus*, Rüpp.
49. —— *citrinus*, Rüpp.
50. —— *ceramensis*, Blkr.
51. *Salarias tridactylus*, Bl. Schn.
52. —— *marmoratus*, Benn.
53. —— *edentulus*, Bl. Schn.
54. —— *periophthalmus*, C. & V.
55. —— *quadricornis*, C. & V.
56. —— *caudolineatus*, Gthr.
57. *Atherina lacunosa*, Forst.
58. *Amphiprion ephippium*, Bl.
59. *Pomacentrus scolopsis*, Q. & G.
60. —— *pavo*, Bl.
61. —— *trilineatus*, Ehrenb.
62. *Glyphidodon Dickii*, Liénard.
63. —— *Brownriggii*, Benn.
64. —— *antjerius*, C. & V.
65. —— *uniocellatus*, Q. & G.
66. *Dascyllus aruanus*, L.
67. —— *xanthosoma*, Blkr.
68. *Heliastes lepidurus*, C. & V.
69. *Labroides dimidiatus*, Rüpp.
70. *Chilinus chlorurus*, Bl.
71. —— *punctatus*, Benn.
72. *Pseudochilinus hexatænia*, Blkr.
73. *Epibulus insidiator*, Pall.
74. *Hemigymnus fasciatus*, Thunb.
75. *Stethojulis axillaris*, Q. & G.
76. —— *phecadopleura*, Blkr.
77. —— *Casturi*, Renard.

78. *Platyglossus hortulanus*, Lacép.
79. —— *opercularis*, Gthr.
80. —— *trimaculatus*, Q. & G.
81. —— *notopsis*, K. & v. H.
82. —— *nigromaculatus*, Gthr.
83. *Julis amblycephalus*, Blkr.
84. —— *umbrostigma*, Rüpp.
85. —— *dorsalis*, Q. & G.
86. *Gomphosus varius*, Lacép.
87. *Coris Greenoughii*, Gthr.
88. *Fierasfer Homei*, Richards.
89. —— *gracilis*, Blkr.
90. —— *parvipinnis*, Kaup.
91. *Belone depressa*, Gthr.
92. *Ophichthys colubrinus*, Bodd.
93. *Muræna Petelli*, Blkr.
94. —— *fimbriata*, Benn.
95. —— *undulata*, Lacép.
96. —— *flavomarginata*, Rüpp.
97. *Gymnomuræna marmorata*, Lacép.
98. *Doryichthys sculptus*, Gthr.
99. —— *excisus*, Kaup.
100. *Balistes aculeatus*, L.
101. —— *rectangulus*, Bl. Schn.
102. —— *undulatus*, Mungo Park.
103. *Monacanthus scopas*, Cuv.
104. —— *longirostris*, Bl. Schn.
105. —— *melanocephalus*, Blkr.
106. *Tetrodon papua*, Blkr.
107. —— *Valentini*, Blkr.
108. *Ostracion cubicus*, L.

XLIII.—*On some little-known Snakes from Natal.*

By G. A. Boulenger, F.R.S.

I am indebted to Mr. Queckett, Curator of the Durban Museum, for an opportunity of examining a large collection of Snakes from the neighbourhood of Durban, comprising examples of several little-known species upon which it is deemed advisable to offer some remarks.

Simocephalus capensis, Smith.

A fine male specimen, measuring 1210 millim.; tail 165. Frontal slightly longer than broad, four fifths the length of

the parietals; the præfrontals have a tendency to divide, a cleft extending along half of their length from the posterior angle of the internasal; loreal square; two præoculars, upper smaller; two postoculars; temporals 1+2; seven upper labials, third and fourth entering the eye. Scales in 15 rows (19 on the neck). Ventrals 208; subcaudals 47. Dark olive-brown, with a yellow vertebral stripe.

Philothamnus semivariegatus, Smith.

A female specimen, measuring 940 millim.; tail 310.

This is of interest as the first specimen received from Natal, the original locality whence the species was described by Andrew Smith. It agrees with the types in the black markings, but differs in the ground-colour being entirely of a bright grass-green above. Temporals 2+2; nine upper labials, fourth, fifth, and sixth entering the eye. Ventrals 178; subcaudals 125.

Macrelaps microlepidotus, Gthr.

Two fine female specimens, the larger measuring 1 metre (tail 110 millim.). This is remarkable in having the rostral nearly twice as broad as deep, its upper portion measuring one third its distance from the frontal. Both have the postocular in contact with the anterior temporal and 25 rows of scales. Ventrals 168, 162; subcaudals 27, 33.

Elapechis Sundevallii, Smith.

I have now several specimens before me, which differ much in coloration. The adult (up to 880 millim.; tail 55) are dark brown above, with narrow white cross-bars nearly equidistant or approximate in pairs, their number varying from 48 to 69; one specimen has the belly marbled with brown. A young specimen (250 millim.) is alternately barred black and white, the two bars of equal extent, the edges of the white ones of a purer white, which no doubt persist to form the narrow bars of the adult. In some of the specimens the upper part of the rostral measures only two thirds its distance from the frontal. Ventrals 165–184; subcaudals 22–25.

This snake has recently been recorded from the Upper Zambesi by Peracca (Boll. Mus. Torin. xi. 1896, no. 255).

Naia nigricollis, Reinh.

I have recently recorded this species from the De Kaap

Goldfields, Transvaal, where a young specimen was collected by Dr. Percy Rendall. Its discovery in Natal extends its habitat further to the south.

Two specimens are in the collection, belonging to the var. *mossambica*, Peters:—An adult female, uniform brown, with a broad black cross-bar under the neck, preceded and followed by a narrow, imperfect one; 27 scales round the neck, 23 round the body; ventrals 187; subcaudals 61. A young, grey above, yellowish beneath, with several irregular black bars under the neck; 29 scales round the neck, 25 round the body; ventrals 195; subcaudals 58.

Dendraspis angusticeps, Smith.

Four specimens:—

1. ♂ (2360 millim.). Scales in 21 rows; ventrals 253; subcaudals 117; 3 præ- and 3 postoculars; fourth labial entering the eye. Blackish brown above.
2. ♂ (1890 millim.). Scales in 19 rows; ventrals 209; subcaudals 107; 3 præ- and 4 postoculars; fourth labial entering the eye. Green above.
3. ♂ (1750 millim.). Scales in 20 rows; ventrals 205; subcaudals 100; 3 præ- and 4 postoculars; fourth labial entering the eye. Pale olive above.
4. ♀ (1600 millim.). Scales in 19 rows; ventrals 209; subcaudals 99; 2 præ- and 4 postoculars; third and fourth labials entering the eye. Green above.

XLIV.—*Note on a new Antelope.*

By the Hon. Walter Rothschild.

Bubalis Neumanni, sp. n.

Mr. A. H. Neumann, during his recent travels in some of the most interesting parts of Africa, on the east shore of and to the north-east of Lake Rudolph, met with a Hartebeest which I cannot refer to any of the already known forms, and which I wish to name after its discoverer. I have before me two skulls with horns, of a male and of a female, and parts of the skin of the body.

The horns differ widely from those of *Bubalis major* (Blyth), of West Africa, and *B. buselaphus* (Pall.), of Northern Africa and Arabia, in being slenderer and in their tips being inverted, instead of pointing outwards or straight behind. The nearest ally seems to be *B. tora* (Gray) of Upper Nubia,

Abyssinia, and Kordofan, which, however, has more slender horns, with more distinct rings, reaching almost round, a broader forehead, and a generally paler coloration. The horns also diverge much more in *B. tora*, as shown at a glance by the distances between the tips of the horns, as recorded in R. Ward's 'Horn Measurements.' *B. Neumanni* has evidently nothing to do with *Acronotus lelwel*, Heugl. (Reise N.O.-Afr. ii. p. 124), in which the tips of the horns point straight outwards. Matschie has referred *A. lelwel* to the West-African Bubal, but Sclater and Thomas have more correctly placed it among the synonyms of *B. buselaphus*. However, a query should be added to the name, the description not being exact enough to make out what the name means. The type is not in the museum at Stuttgart, according to kind information of Prof. Lampert, nor can it be found elsewhere at present.

The horns of *B. Neumanni* measure as follows:—

Circumference at base, ♂ 273 millim., ♀ 183; total length along the curves, ♂ 420, ♀ 345; tip to tip, ♂ 206, ♀ 249.

The rings of the horns are not very prominent and do not reach all round.

Breadth of skull at forehead, ♂ 100 millim., ♀ 80; length of skull from base of horn to upper lip, along the side in a straight line: ♂ 430, ♀ 403 millim.

Colour of hair fulvous fawn, much richer on the back, where there are also some darker spots, which may be stains or natural; below very much paler. Chin blackish, tip of tail black. The male is brighter and darker in colour than the female. There are also on the back some patches with longer, thicker, almost whitish-buff hair, perhaps remains of the winter fur.

XLV.—*On the Dwarf Mungoose* (Helogale) *of Somaliland.*

By Oldfield Thomas.

The recent presentation to the British Museum of a *Helogale* obtained by Dr. A. E. Atkinson when with Lord Delamere's shooting-party in Somaliland has enabled me to examine more carefully the characters of this mungoose, which has been assigned by Rhoads* and Elliot† to *H. undulata*, Peters. The specimens referred to by both these authors had passed through London and been provisionally referred to

* Proc. Ac. Philad. 1896, p. 543.

† Field Columbian Museum Publ., Zool. i. p. 147 (1897).

H. undulata; but no opportunity had occurred of making a detailed examination of the skulls and other characters. On now making such a comparison with Dr. Atkinson's specimen, I find that, although undoubtedly nearly allied, it is sufficiently distinct to demand specific separation. I would propose to call it, in honour of its collector, to whom the Museum is indebted for an interesting series of Somali mammals,

Helogale Atkinsoni, sp. n.

Very similar in external appearance to *H. undulata*, and especially to the darker-coloured individuals of that species. It is, however, rather darker than the darkest, with less rufous or fulvous in the general tone, the chest and belly are browner, and the muzzle is blackish brown, as compared to the rufous which occupies this part in all the Museum specimens of *H. undulata*, and is also mentioned by Peters as being present in the types.

Skull with the nasals peculiarly short and broad, extending backwards barely 2 millim. beyond the level of the premaxillary bones, instead of, as in *H. undulata*, running back as a long narrow wedge past the level of the anterior edge of the orbit. Middle upper premolar (p^3) with scarcely a trace of an internal secondary cusp, such as is prominent in all the available skulls of *H. undulata*, five in number, and is mentioned by Peters in his description.

In size *H. Atkinsoni* appears to be just about equal to *H. undulata*, for the type (a rather immature male) has a skull of just the same size as an equally immature male of *H. undulata*, and also just equal to the old female of that species and the old male of *H. parvula*. There appears therefore to be just the same differences between the sexes of *H. undulata* as between the species *undulata* and *parvula*, an old male of the latter just equalling an old female of the former. This question of sexual difference in size was not discussed by Dr. Jentink when he suggested * that *H. undulata* and *H. parvula* were really indistinguishable by size and should not be specifically separated.

Dimensions of the type (a slightly immature male), measured in flesh by the collector:—

Head and body 192 millim.; tail 153; hind foot 41; ear 17.

Skull: basal length 41·7; greatest breadth 25·6; nasals, length in middle line 5·1; interorbital breadth 10·2; breadth

* N. L. M. xi. p. 31 (1888).

of brain-case 22; palate length 22·5, breadth between outer corners of p^4 16; greatest horizontal diameter of p^4 5·1, of m^2 3·4.

Hab. Hargaisa, Somaliland, alt. 1500 m.

Type collected by Dr. A. E. Atkinson, Oct. 26, 1896.

Native name "Shog Shog."

XLVI.—*The Nomenclature of some European Bats.*

By Gerrit S. Miller, Jr.

While working out the synonymy of the North-American Vespertilionidæ I have found that some glaring errors now pass current in the nomenclature of several European bats. These may be most conveniently discussed under three headings: (I.) the genera *Vespertilio* and *Myotis*, (II.) the genera *Pipistrellus* and *Pterygistes*, and (III.) the genus *Barbastella*.

I. *The Genera* Vespertilio *and* Myotis.

The generic name *Vespertilio* has long been applied to the 38-toothed members of the family Vespertilionidæ, but in accordance with one of the fundamental laws of nomenclature—that when a composite genus is subdivided its name can never be transferred to a group not included in the original assemblage—this use of the name is inadmissible. The genus *Vespertilio*, Linnæus ('Systema Naturæ,' i. ed. x. pp. 31–32, 1758), included seven species—*vampyrus*, *spectrum*, *perspicillatus*, *spasma*, *leporinus*, *auritus*, and *murinus*. Only two of these, *auritus* and *murinus*, are European. Since it is clear that a non-exotic species should in such a case be made the type of the genus, on the ground that in this way the original meaning of the author will be most closely retained, one of these two must be selected. The species *auritus* was removed to the genus *Plecotus* by Geoffroy in 1818 (Descr. de l'Égypte, Mammif. p. 112). Thus *murinus* is left as the type of the genus *Vespertilio*. True *Vespertilio murinus*, however, is a totally different animal from the one commonly known by that name. To understand the matter fully it is necessary to refer to the two editions of the 'Fauna Suecica,' where Linnæus describes the animal in more detail than in the 'Systema Naturæ.' In the first edition he mentions only one bat, the "Läderlapp," "Flädermus," or "Natt-blacka." This he calls "*Vespertilio caudatus, naso oreque simplici*" (No. 18, p. 7, 1746). In the second edition two

species are mentioned, No. 18 of the first edition (here numbered 2) and the long-eared bat, "*V. caudatus, naso oreque simplici, auriculis duplicatis, capite majoribus*" (pp. 1–2, 1761). These had already received binomial names, *Vespertilio murinus* and *V. auritus* respectively, in the tenth edition of the 'Systema Naturæ,' where the following diagnosis of *V. murinus* is given: "*V. caudatus, naso oreque simplici, auriculis capite minoribus*" (p. 32, 1758). In the second edition of the 'Fauna Suecica' the teeth of *V. murinus* are thus described*:—"Dentes primores superiores 6, acuti distantes; inferiores 4, acuti contigui. Laniarii superiores 2, anteriore majore; inferiores 3, antico maximo. Molares utrinque 3, tricuspidati."

It thus appears that the *Vespertilio murinus* of Linnæus, the type of the genus *Vespertilio*, is a common Scandinavian bat with ears shorter than the head, and with the dental formula $i\frac{2-2}{3-3}$†, $c\frac{1-1}{1-1}$, $pm\frac{1-1}{2-2}$, $m\frac{3-3}{3-3}=32$.

The only known Scandinavian bats which combine these characters are the members of the group commonly known as *Vesperus* in Europe and *Adelonycteris* in America, but to which Mr. Oldfield Thomas has recently applied the name *Eptesicus*, Rafinesque‡. Therefore the genus *Vespertilio* with its principal synonymy stands as follows:—

Vespertilio, Linnæus, 1758.

1758. *Vespertilio*, Linnæus, Systema Naturæ, i. ed. x. pp. 31–32. Type by elimination *Vespertilio murinus*, Linnæus (not *V. murinus*, Schreber, 1775).

1820. *Eptesicus*, Rafinesque, Annals of Nature, p. 2. Type *Eptesicus melanops*, Rafinesque,= *Vespertilio fuscus*, Beauvois.

1829. *Cnephæus*, Kaup, Skizzirte Entw.-Gesch. u. natürl. Syst. der europ. Thierw. 1ster Theil, p. 103. Type *Vespertilio serotinus*, Schreber.

1839. *Vesperugo*, Keyserling & Blasius, Wiegmann's Archiv für Naturgeschichte, v. Bd. i. p. 312 (part.).

1839. *Vesperus*, Keyserling & Blasius, Wiegmann's Archiv für Naturgeschichte, v. Bd. i. p. 313. Based on the 32-toothed species of "*Vesperugo*."

1841. *Noctula*, Bonaparte, Iconografia Fauna Italica, i. fasc. xxi. (under *Vespertilio alcythoe*). Type *Vespertilio serotinus*.

1856. *Cateorus*, Kolenati, Allgem. deutsch. naturhist. Zeitg. Dresden, neue Folge, ii. pp. 131, 162–163. Type "*Vesperugo*" *serotinus*.

1856. *Meteorus*, Kolenati, Allgem. deutsch. naturhist. Zeitg. Dresden,

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* In the first edition the dental formula is the same, except that the lower incisors are said to be five in number, an error corrected in the second edition.

† In Linnæus's statement the figures 4 and 6 are evidently transposed.

‡ Proc. Zool. Soc. Lond. 1896, pt. iv. p. 791, April 1, 1897.

neue Folge, ii. pp. 131, 167–169 (included *Nilssoni*, *discolor*, *Savii*, *leucippe*, and *aristippe*).

1878. *Vesperugo*, Dobson, Catal. Chiroptera Brit. Mus. p. 183 (part.).

1892. *Adelonycteris*, H. Allen, Proc. Acad. Nat. Sci. Philad. (1891) p. 466, January 19, 1892. Proposed as a substitute for *Vesperus*, preoccupied in entomology.

The exact identification of the species *murinus* among the Scandinavian members of the genus *Vespertilio*, although a matter of considerable difficulty, does not affect the use of the generic name. Nilsson *, after a careful review of the facts, decided that the animal must have been the bat to which Natterer afterward applied the name *discolor*. He therefore very properly placed the latter in the synonymy of *V. murinus*, Linnæus, and reinstated Bechstein's name *myotis* for the *Vespertilio murinus* of Schreber. Nilsson did not recognize "*Vesperugo*" as distinct from "*Vespertilio*." Hence he said nothing in regard to the tenability of the generic names. Ten years later, Blasius †, though admitting that the *Vespertilio murinus* of Linnæus could not be the bat commonly known by that name, considered the species undeterminable, and therefore reasoned that the name first applied to it might afterward be properly used by Schreber in a different sense. It is not surprising, then, that Blasius continued to apply the name *Vespertilio*, Linnæus, to the genus to which he had restricted it eighteen years before, notwithstanding the fact that, according to his own statement, it could not be made to include any of the Linnæan species. In these rulings Blasius was followed by Lilljeborg ‡, who gave detailed reasons for his belief that it is impossible to determine whether Linnæus's bat is the species afterwards called *Vespertilio discolor* by Natterer, or that called *Vespertilio Nilssoni* by Keyserling and Blasius. In his opinion, contrary to that of Nilsson, the odds are in favour of the latter. Lilljeborg calls attention to Blasius's mistake in applying the generic name *Vespertilio* to a group containing no species known to Linnæus, but concludes that since this error has become time honoured, it were better uncorrected.

Notwithstanding the inconvenience to which such a course leads, there can scarcely be any valid reason for rejecting the identification of Linnæus's *Vespertilio murinus* made by Nilsson. The doubt admittedly lies between two species, one of which he deliberately chose with all the facts before him. As nothing in the original description is in any way

* Skand. Fauna, Däggdjuren, pp. 17–20 (andra upplagen) (1847).

† Fauna der Wirbelthiere Deutschlands, Säugethiere, p. 74 (1857).

‡ Sveriges och Norges Ryggradsdjur, i. pp. 124–126, 144 (1874).

discrepant with this determination it should be adopted. The synonymy of the species is as follows :—

Vespertilio murinus, Linnæus.

1758. *Vespertilio murinus*, Linnæus, Systema Naturæ, i. ed. x. p. 32.
1819. *Vespertilio discolor*, Natterer, in Kuhl, Deutsch. Flederm. p. 43.
1839. *Vesperugo discolor*, Keyserling & Blasius, Wiegmann's Archiv für Naturgeschichte, v. Bd. i. p. 312.
1847. *Vespertilio murinus*, Nilsson, Skand. Fauna, Däggdjuren, p. 17 (andra upplagen).
1878. *Vesperugo discolor*, Dobson, Catal. Chiropt. Brit. Mus. p. 204.

The Serotine becomes

Vespertilio serotinus, Schreber.

The bat usually called *Vesperugo borealis* by recent writers must be known as

Vespertilio Nilssoni (Keyserling & Blasius).

1836. *Vespertilio Kuhlii*, Nilsson, Illum. Fig. Scandin. Fauna, Häft 17, pl. 34 (not *V. Kuhlii*, Natterer, in Kuhl, Deutsch. Flederm. p. 58, 1817).
1838. *Vespertilio borealis*, Nilsson, Illum. Fig. Scandin. Fauna, Häft 19, pl. 36 (not *Vespertilio borealis*, Müller, Natursyst. Suppl. p. 21, 1776).
1839. *Vesperugo Nilssoni*, Keyserling & Blasius, Wiegmann's Archiv für Naturgeschichte, v. Bd. i. p. 315.
1878. *Vesperugo borealis*, Dobson, Catal. Chiroptera Brit. Mus. p. 203.
1894. *Vesperugo Nilssoni*, Rhoads, Reprint of Ord's North-American Zoology, Appendix, p. 3.

The genus *Vespertilio* of Linnæus contained, as already shown, none of the 38-toothed bats to which the name is generally applied. For these bats therefore the name must be replaced by *Myotis*, Kaup, the first based on a member of this group. Hence the genus *Vespertilio* of authors becomes

Myotis, Kaup, 1829.

1829. *Myotis*, Kaup, Skizzirte Entw.-Gesch. u. natürl. Syst. der europ. Thierw. 1ster Theil, p. 106. Type *Vespertilio murinus*, Schreber (not *V. murinus*, Linnæus).
1829. *Nystactes*, Kaup, Skizzirte Entw.-Gesch. u. natürl. Syst. der europ. Thierw. 1ster Theil, p. 108. Type *Vespertilio Bechsteinii*, Leisler.
1839. *Vespertilio*, Keyserling & Blasius, Wiegmann's Archiv für Naturgeschichte, v. Bd. i. p. 306. (Not *Vespertilio*, Linnæus, 1758.)
1841. *Selysius*, Bonaparte, Iconografia Fauna Italica, i. Introduzione [p. 3]. Type *Vespertilio mystacinus*, Leisler.
1856. *Brachyotus*, Kolenati, Allgem. deutsch. naturhist. Zeitg. Dresden, neue Folge, ii. pp. 131, 174–177. Based on the species *mystacinus*, *Daubentonii*, and *dasycnemus*.

1856. *Isotus*, Kolenati, Allgem. deutsch. naturhist. Zeitg. Dresden, neue Folge, ii. pp. 131, 177–179. Included the species *Nattereri* and *emarginatus*.

1870. *Acorestes*, Fitzinger, Sitzungsber. math.-nat. Cl. k. Akad. Wissensch. Wien, lxii. Abth. i. pp. 427–436. Included the species *villosissimus*, *albescens*, *nigricans*, and *levis*.

1870. *Comastes*, Fitzinger, Sitzungsber. math.-nat. Cl. k. Akad. Wissensch. Wien, lxii. Abth. iv. p. 39. Included *Capuccinii*, *megapodius*, *dasycnemus*, and *limnophilus*.

1878. *Vespertilio*, Dobson, Catal. Chiroptera Brit. Mus. p. 284 (not *Vespertilio*, Linnæus, 1758).

The specific name *Vespertilio murinus*, Schreber, 1775, is preoccupied by *V. murinus*, Linnæus, 1758. As already pointed out by Nilsson, it must therefore give way to *Vespertilio myotis*, Bechstein, 1791. The common, large, 38-toothed bat of Central and Southern Europe is then

Myotis myotis (Bechstein).

1775. *Vespertilio murinus*, Schreber, Säugthiere, i. p. 165, pl. li. (not *Vespertilio murinus*, Linnæus, 1758).

1791. *Vespertilio myotis*, Bechstein, Naturgesch. Deutschl. i. p. 1154.

1839. *Vespertilio murinus*, Keyserling & Blasius, Wiegmann's Archiv für Naturgeschichte, v. Bd. i. p. 306 (not *V. murinus*, Linnæus, 1758).

1847. *Vespertilio myotis*, Nilsson, Skand. Fauna, Däggdjuren, p. 20 (andra upplagen).

1878. *Vespertilio murinus*, Dobson, Catal. Chiroptera Brit. Mus. p. 309 (not *V. murinus*, Linnæus, 1758).

II. *The Genera* Pipistrellus *and* Pterygistes.

It has already been shown that one of the several genera commonly associated as subgenera under the name *Vesperugo* must take the name *Vespertilio*. It remains to show that the name *Vesperugo* cannot be used in any sense.

As originally defined by Keyserling and Blasius, the genus *Vesperugo* included twelve species: *serotinus*, *discolor*, *Nilssoni*, *Savii*, *leucippe*, *aristippe*, *noctula*, *Leisleri*, *Kuhlii*, *albolimbatus*, *Nathusii*, and *pipistrellus*. These were arranged in two subgenera—*Vesperugo*, including the 34-toothed species, and *Vesperus*, those with 32 teeth. The subgenus *Vesperus* is exactly equivalent to the restricted genus *Vespertilio*, Linnæus, to the genus *Eptesicus*, Rafinesque, and to the genus *Cnephæus*, Kaup, each of which antedates it. Aside from this, however, it would be necessary to find the type of the genus among the species referred by the authors to the typical subgenus. These represent two modern groups—the first consisting of *noctula* and *Leisleri*, the second of the

remaining 34-toothed species. Each of these groups had been named by Kaup ten years previously. Therefore each of the constituent parts of the genus *Vesperugo* was provided with a tenable name at the time when the composite genus was formed. The first of the two genera into which the original subgenus *Vesperugo* is now divided is

PIPISTRELLUS, Kaup, 1829.

1829. *Pipistrellus*, Kaup, Skizzirte Entw.-Gesch. u. natürl. Syst. der europ. Thierw. 1ster Theil, p. 98. Type *Vespertilio pipistrellus*, Schreber.
1839. *Vesperugo*, Keyserling & Blasius, Wiegmann's Archiv für Naturgeschichte, v. Bd. i. p. 312 (part.).
1856. *Nannugo*, Kolenati, Allgem. deutsch. naturhist. Zeitg. Dresden, neue Folge, ii. pp. 131, 169–172. Based on *Nathusii*, *pipistrellus*, and *Kuhlii*.
1856. *Hypsugo*, Kolenati, Allgem. deutsch. naturhist. Zeitg. Dresden, neue Folge, ii. pp. 131, 167–169. Included "*Vesperugo*" *maurus*, Blasius, and "*V.*" *Krascheninikovii*, Eversmann.
1878. *Vesperugo*, Dobson, Catal. Chiroptera Brit. Mus. p. 183 (part.).
1893. *Vesperugo*, H. Allen, Monogr. Bats N. Am. p. 121.

The type species, the Pipistrelle, is therefore

Pipistrellus pipistrellus (Schreber).

The second of the included genera is

PTERYGISTES, Kaup, 1829.

1829. *Pterygistes*, Kaup, Skizzirte Entw.-Gesch. u. natürl. Syst. der europ. Thierw. 1ster Theil, pp. 99, 100. Type *Vespertilio noctula*, Schreber.
1839. *Vesperugo*, Keyserling & Blasius, Wiegmann's Archiv für Naturgeschichte, v. Bd. i. p. 312 (part.).
1842. *Noctulinia*, Gray, Ann. & Mag. Nat. Hist. x. p. 258. Included *proterus* and *fulvus*.
1856. *Panugo*, Kolenati, Allgem. deutsch. naturhist. Zeitg. Dresden, neue Folge, ii. pp. 131, 172–174. Included *noctula* and *Leisleri*.
1878. *Vesperugo*, Dobson, Catal. Chiropt. Brit. Mus. p. 183 (part.).
1893. *Noctulinia*, H. Allen, Proc. U.S. National Museum, p. 30.

The type will stand as

Pterygistes noctula (Schreber).

III. *The Genus* Barbastella.

In Dobson's Catalogue of the Chiroptera in the British Museum the generic name *Barbastellus* is discarded in favour of *Synotus*, Keyserling and Blasius, 1839, on the ground that it was first applied to a species of *Nyctophilus* *.

* P. 175, footnote.

While the name was so used by Gray in 1831, it had been applied by him to the Barbastelle under the slightly different form *Barbastella* ten years previously. Therefore it must be retained for the genus represented by that species. The synonymy is as follows :—

BARBASTELLA, Gray, 1821.

1821. *Barbastella*, Gray, London Medical Repository, xv. p. 300. Type *Vespertilio barbastellus*, Schreber.

1839. *Synotus*, Keyserling & Blasius, Wiegmann's Archiv für Naturgeschichte, v. Bd. i. p. 305. Type *Vespertilio barbastellus*, Schreber.

The type species is therefore

Barbastella barbastellus (Schreber).

The specific name *barbastellus* is a masculine substantive, and does not change its termination when combined with a feminine generic name.

XLVII.—*A Revision of the Species of Butterflies belonging to the Genus* Teracolus, *Swains.* By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

IT is now upwards of twenty years since I first essayed a Monograph of this most attractive group of Pieridine Rhopalocera, and horrified my old friend Hewitson by adding nearly fifty species to those already described. Since that date many beautiful new forms have been received from various parts of Africa and from Arabia.

Until quite recently the variation of the species of *Teracolus* has been but little studied, very few facts bearing upon the seasonal modifications of the different forms having been published. It is true that so far back as 1877 Mr. Mansel Weale (Trans. Ent. Soc. 1877, pp. 273–5) proved by experiment that *T. keiskamma* and *T. auxo* were produced from exactly similar larvæ and pupæ found upon a *Cadaba* bush in autumn and spring, and he suggested that they were variations influenced by the amount of moisture at the season of their emergence. This suggestion, however, was received with a good deal of scepticism.

In vol. viii. of the 'Journal of the Bombay Natural History Society' Capt. E. Y. Watson, of the Indian Staff Corps, published an article on the synonymy of some species of Indian Pieridæ, in which he reduced the Oriental *Teracoli* to

twelve, expressing his firm conviction that all the other described forms were seasonal. So revolutionary a measure naturally met with considerable opposition at first, and is even now laughed to scorn by some lepidopterists; but each collection received from the tropical parts of the Old World tends to prove that certain laws regulate the seasonal modification of Pierine butterflies and are never departed from.

In the wet season Pierinæ are heavily marked with black spots, borders, and sometimes veins, often on both surfaces (though especially above); the under surface has a white or yellow ground-tint. In the dry season the under (and sometimes the upper) surface shows much less black marking, and is frequently suffused with clay-colour, ochreous, or rose-red; frequently, but especially when the ground-tint remains white, the apical area of the primaries and the whole surface of the secondaries are irrorated or finely striated with brown.

The seasonal character of the above differences has been amply proved as regards the species of *Teracolus*, so that it is now possible to recognize a dry- or a wet-season form at sight; nor is the fact that dated examples have been critically examined by any means the only evidence upon which conclusions have been based, or even the unhesitating declarations of collectors in India and Africa, for in some cases the one form has been bred from eggs laid by the other, *T. auxo* having been proved recently by Mr. Guy A. K. Marshall to be the wet-season form of *T. keiskamma*, as supposed by Mr. Mansel Weale.

Col. Charles Swinhoe objected to Capt. Watson's decisions respecting the seasonal forms of certain Eastern *Teracoli* on the ground that he took them all flying simultaneously at Karachi—a fact which can be proved by an examination of the dates on the labels even of the Museum examples. It must, however, be borne in mind that in countries where practically no wet season exists great variation is often to be found, as pointed out by me in the case of *Limnas chrysippus*, *Catopsilia florella*, &c. (Proc. Zool. Soc. 1884, pp. 478–503), which there retain all the forms as simple sports of one variable species which in other parts of the Old World become fixed as local types. In like manner I find that phases answerable to dry-, intermediate, and wet-season forms exist in many species of Karachi and Arabia, and are simultaneously produced. As an instance, Capt. Nurse bred *T. Yerburii* and *T. evagore* from a series of exactly similar larvæ, the perfect insects emerging at the same season.

Again, lest it should be supposed that the yellow or ochraceous under-surface coloration was of specific importance, it

is noteworthy that the Arabian *T. phisadia* has a male of the wet-season phase and a female of the dry type; also that the nearly allied *T. pullaris* occurs at Karachi with males both of the wet and dry phases, but females of the dry phase only.

Another point which proves the seasonal character of these different variations, wherever seasons can be said to exist, is that an unusually wet country invariably increases the wet characteristics, and an unusually dry country has the same effect upon the dry type of the species; thus the dry form of *T. subfasciatus* from the Nyasa-Tanganyika plateau, where the country is almost a desert in the dry season (though extremely moist during the rains), is much more emphasized than it is in southern South Africa, so much so that it was described as a different species.

In the spring of 1896 Mr. Guy A. K. Marshall, one of the most painstaking and indefatigable collectors who has visited the so-called "Dark Continent," came to the Museum with the view of applying the experience gained by him in Mashunaland to the magnificent collection under my charge. Finding how rich we were in both examples and species of the genus *Teracolus*, and observing that the wet and dry forms were at that time kept separate as distinct species, Mr. Marshall made up his mind to thoroughly revise the synonymy of the genus. Had he waited until I had rearranged our material, which was cumbered by masses of only half-determined specimens (so crowded together that the labels could with difficulty be distinguished), he might have produced a really satisfactory memoir. As, however, he elected to go to work upon the genus in its crowded condition, it is not surprising that his synonymic work is not only more or less overdone, but in some cases confounds species appertaining to widely distinct groups. At the same time much that Mr. Marshall has suggested in his paper (Proc. Zool. Soc. 1897) is undoubtedly correct, and perhaps the fact that the work of this reviser calls loudly for revision in certain points may have been beneficial as inciting me to especial care in studying the sexes and seasonal forms, with due regard to the geographical range of each species, in order that I might not only straighten out the inequalities which certainly exist, but avoid the error of making confusion worse confounded. How far I have succeeded future students of the genus will have to decide. It is probable that some forms which I have not seen any justification for suppressing may yet prove not to be good species, and it may be that in one or two cases I may, like my friend Mr. Marshall, have gone a little too far.

1. *Teracolus amatus.*

Papilio amatus, Fabricius, Syst. Ent. p. 476 (1775).
Papilio calais, Cramer, Pap. Exot. i. pl. liii. C, D (1779).
Papilio cypræa, Fabricius, Mant. Ins. ii. p. 22 (1787).
Papilio dynamene, Klug, Symb. Phys. pl. vi. figs. 17, 18 (1829).
Teracolus modestus, Butler, P. Z. S. 1876, p. 137.
Teracolus carnifer, Butler, *t. c.* p. 138, pl. vii. figs. 8, 9.
Teracolus Kennedii, Swinhoe, P. Z. S. 1884, p. 440.

Wet-season form *T. calais* (=*dynamene*).

Occurs over a great part of tropical Africa, from the Congo westwards to the Zambesi eastwards, whence it ranges northwards towards the eastern coast to Abyssinia, passing through the Sabaki valley, Somaliland, whence it probably crosses over to Arabia, and thence through Syria and Persia to North-western India. The most vividly coloured specimens are those received from the Congo and Angola, but they grade imperceptibly into the lightest examples of *T. dynamene*, whilst the latter also grade into the following, from which many attempts have been made to keep them distinct, even by Mr. Guy A. K. Marshall in his recent review of the synonymy of *Teracolus*:—

T. amatus (=*cypræa*=*modestus*=*Kennedii*).

This is merely a more southern development of *T. calais* in India and Ceylon, most examples differing in the smaller black discocellular spot on the primaries, the Ceylonese examples (*T. modestus*) also generally with a heavier black border; but intermediate specimens exist which, to my mind, render it impossible to keep them apart. Roughly speaking, *T. amatus* may be said to range throughout the plains of Central and Southern India, occurring as *T. modestus* in Ceylon. *T. cypræa* is the white form of the female.

Dry-season form *T. carnifer*.

From Arabia through Persia to Karachi. In Central and Southern India and Ceylon it is represented by a much larger and more heavily bordered form, a white female to which sometimes occurs.

Altogether the Museum series is represented by ninety-seven specimens.

2. *Teracolus protractus.*

Teracolus protractus, Butler, P. Z. S. 1876, p. 137.

Described from a dry-season example obtained in the Punjab; it occurs commonly at Campbellpore, Beluchistan, and Kutch.

The wet-season variety has the apex of the primaries and the secondaries greenish yellow instead of pinky buff on the under surface; intermediate specimens also occur, and it may be doubted whether the three forms do not all fly simultaneously, as is frequently the case in very dry regions.

There are altogether seventeen specimens in the Museum series.

3. *Teracolus ocellatus.*

Teracolus ocellatus, Butler, P. Z. S. 1885, p. 767.

A single wet-season male of this still rare species was obtained by Mr. J. G. Thrupp in Somaliland in 1884; I have since seen a second example in Miss E. M. Sharpe's collection. I had long expected to see this butterfly before it actually came to hand, as I felt certain that some intermediate form must exist between the salmon-coloured *T. protractus* and the half-salmon, half-white *T. phisadia*. As might be expected, *T. ocellatus* is somewhat nearer to *T. phisadia* than to the Indian species, both in outline and in the general pattern of the primaries. The dry-season form is at present unknown, but it is quite possible that, as in *T. phisadia*, it may only represent the female phase of the species.

4. *Teracolus phisadia.*

Teracolus phisadia, Godart, Enc. Méth. ix. p. 132 (1819).
Pontia arne, Klug, Symb. Phys. pl. vii. figs. 1–4 (1829).
Idmais philamene, Mabille, C. R. Ent. Belg. xxxiii. p. cvi (1880); Grand. Madag. p. 284, pl. xli. figs. 10, 10*a* (1887).

The male of this species is a wet-season form and the female (in all its varieties) invariably dry-season; of course they all fly together at the same time. The species occurs abundantly in Arabia and ranges to Syria. According to Mr. Marshall it also occurs through Abyssinia to Senegal, but I have never seen an African specimen; its reputed occurrence in Madagascar is doubtless due to an error in the labelling of a collection from Aden containing single examples of many species which have been thus included in M. Grandidier's splendid work by M. Mabille. It would, indeed, be remarkable if Adenese species could leap over Somaliland and the intermediate sea to Madagascar without appearing upon the African continent.

5. *Teracolus puellaris.*

Teracolus puellaris, Butler, P. Z. S. 1876, p. 136.
Teracolus ochreipennis, Butler, *t. c.* p. 136.
Teracolus rorus, Swinhoe, P. Z. S. 1884, p. 437, pl. xxxix. fig. 8.

Occurs from Kutch, through Karachi, through Sind north-

wards as far as Beluchistan, both dry- and wet-season forms flying together; the form with yellow under surface, which is the wet-season representative, is *T. puellaris*, and that with the apex of primaries and the whole of the secondaries sandy buff on the under surface, which is the dry-season type, is *T. ochreipennis* (= *T. rorus*). We have both forms captured on the 29th of June and in November. It is therefore evident that, as in some other dry localities, the seasonal forms in this species represent mere varieties which appear simultaneously. Among Hewitson's examples of *T. phisadia* is a male of the wet-season form labelled "Aden"; but this must surely be an error, unless the white females referred to *T. phisadia*, and obtained at my request by Col. Yerbury, flying with the latter species, actually belong to the dry-season variety of *T. puellaris*. This, however, is extremely improbable *.

6. *Teracolus vestalis*.

Teracolus vestalis, Butler, P. Z. S. 1876, p. 135, pl. vii. fig. 10.
Teracolus intermissus, Butler, P. Z. S. 1883, p. 152, pl. xxiv. fig. 4.
Teracolus peelus, Swinhoe, P. Z. S. 1884, p. 438, pl. xxxix. fig. 9.
Teracolus dubius, Swinhoe, *t. c.* p. 439.

Occurs from Kutch through Karachi and Beluchistan to the coast of Persia. The varieties representative of seasonal forms in this species fly together in April, May, and June; but we have only received the dry-season types as obtained in November and December. The wet-season type is typical *T. vestalis* (= *T. dubius*); the dry and intermediate types are represented by *T. intermissus*, of which *T. peelus* is only a yellow female form, Swinhoe's supposed male being merely a small example.

7. *Teracolus castalis*.

Idmais castalis, Staudinger, Exot. Schmett. p. 43, pl. xxiii. (1884).

Originally described from an imperfect example obtained at Taita, E. Africa; it has subsequently been received from Mombasa and from Somaliland. In the Museum there is one male from Mombasa of the typical wet-season form.

T. castalis is the African representative of *T. vestalis*, from which the longer costa of the primaries, the broader black apical and costal borders of these wings, and the distinctly spotted border of the secondaries readily distinguish it.

* Hewitson's utter disregard of the importance of correct habitats is evidenced by the fact that fully half his specimens bear no indication of locality.

8. *Teracolus Johnstoni.*

Teracolus Johnstoni, Butler, Ent. Month. Mag. xxiii. p. 29 (1886).
Teracolus eris (part.), Trimen, South Afr. Butt. iii. p. 93 (1889).

Ranges in South Africa from Graham's Town to Natal, beyond which point it is probably replaced by *T. opalescens*. It is one of the smallest of the *T. eris* group, being (in its largest examples) only slightly superior in size to the typical form, from which it differs in its more elongated primaries, the more elongate form of the white area on these wings and of the apical ochraceous streaks or internervular spots, the less heavily bordered inner marginal black border on the primaries of the female, and the more abruptly terminated black costal band on the secondaries, which emits an acute streak to the apex along the costa, instead of being extended transversely almost to the radial vein.

9. *Teracolus eris.*

Pontia eris, Klug, Symb. Phys., Ins. pl. vi. figs. 15, 16 (1829).
♀. *Idmais fatma*, Felder, Reise der Nov., Lep. p. 189, pl. xxv. fig. 3 (1865).
♀. *Teracolus abyssinicus*, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 486 (1876).

Ranges northwards from the Sabaki valley and Kilimanjaro to Abyssinia and Nubia, and westwards to Kordofan. The *Idmais fatma* of Felder is the dry-season form of the female.

10. *Teracolus opalescens.*

♀. *Teracolus opalescens*, Butler, Ent. Month. Mag. xxiii. p. 30 (1886); ♂. P. Z. S. 1896, p. 125.

Ranges from Delagoa Bay inland and northwards through Nyasaland to the Victoria Nyanza.

This species attains to a greater size than any of the other forms of the *T. eris* group; it is also the most heavily black-bordered of them all, and has well-defined black marginal spots to the secondaries in both sexes; the white irregular edging to the external angle and lower portion of outer margin of primaries, which is usually well marked in *T. Johnstoni*, is absent, as in *T. eris*. The primaries below have much larger discal black spots than in either of the latter species and three or four marginal black dots, whilst the secondaries have a much broader orange-yellow costal streak and traces of a discal transverse yellow streak from its extremity, also a bright saffron-yellow internal streak; the female has the usual discal internervular series of dots on the under

surface of the secondaries, but the male dry-season form never shows the conspicuous discocellular black spot which characterizes the male of typical *T. Johnstoni*.

Mr. Guy A. K. Marshall, who calls the species *T. opalinus* and sinks it as a synonym of *T. eris*, says that the type is an unusually large female from Delagoa Bay. Of our eight females three ought to be called unusually large, four fairly large, and one rather small; but the name *opalescens* was given to the type because it is faintly opalescent on the upper surface and on the under surface of the primaries, a character which I have since discovered to be inconstant, as also is the width of the internal black bordering of the primaries, which is frequently as wide again as in the type. The dry-season form is smaller than that of the wet-season, the primaries comparatively shorter and broader than in *T. Johnstoni*, with the conspicuous black discal spots below which characterize the wet-season form, and with a series of scaly brown spots across the under surface of the secondaries between the nervures. These characters and the lack of the black discocellular spot readily distinguish it from the dry form of the southern species.

11. *Teracolus maimuna*.

Idmais maimuna, Kirby, Proc. R. Dubl. Soc. (2) ii. p. 338 (1880); Waterhouse, Aid Ident. Ins. ii. pl. cxliii. figs. 1, 2 (1882–90).

The figures of this species are very poor and convey a false impression of it. The range of *T. maimuna* appears to extend on the West Coast from Senegal to Angola; it is a large form, although small examples occasionally are to be found. Of our seven females, one from Angola is larger than the type of *T. opalescens*, whilst the dry-season females are quite small.

This West Coast representative of *T. eris* is at once recognizable in the male sex by the dull smoky character of the apical patch, the spots on which are small and less solid in colouring than in any of the other types; the white area on the primaries is also much broader and terminated less irregularly, the margin of the secondaries is more or less spotted at the extremities of the veins. The wet-season form may always be distinguished from males of *T. opalescens* (in addition to the dullness of the apical patch) by the almost total absence of orange colouring from the under surface of the secondaries, whilst some examples show a discal series of dusky spots across the secondaries; the intermediate season form, which we have chiefly from Senegal, has a well-defined orange costal streak below and a faint trace of a saffron-yellow

internal streak, the under surface varying from pale buff to lemon-yellow. The females much resemble those of *T. opalescens*, but the ground-colouring of the under surface is yellower and the discal spots on the secondaries much more prominent, whilst the orange costal streak is paler. In the dry-season form of the female, apart from the slightly more sandy reddish colouring of the apex and of the secondaries, the absence of subapical spots and of the internal stripe on the upper surface, and the presence of a transverse tapering brown streak from the costa of secondaries on the under surface, serve to distinguish it from females of *T. opalescens*.

12. *Teracolus subfasciatus.*

Teracolus subfasciatus, Swainson, Zool. Ill., Ins. ii. pl. cxv. (1823).
Ptychoptery.x Bohemani, Wallengren, Lep. Rhop. Caffr. p. 18 (1857).
Ptychoptery.x? ducissa, Dognin, Le Naturaliste, p. 132 (1891).

The range of this species is much greater than was formerly supposed. It occurs in Damaraland and Ovampoland, Eastern Griqualand, Northern Transvaal, Matabeleland, Zanguebar, Nyasa, and Uganda.

From the rarity of the dry-season form, it seems probable that it is confined to the drier parts of Eastern and East Central Africa. The female is the sex described by M. Dognin; the male is brimstone-yellow like the wet-season form, but with a clear orange apical patch. Hewitson has two examples of the female from the Transvaal, but the orange area on the upper surface of the primaries is somewhat more restricted in these than in our Nyasa female.

13. *Teracolus elgonensis.*

Teracolus elgonensis, E. M. Sharpe, P. Z. S. 1891, p. 191, pl. xvi. fig. 6 (1891).

Mount Elgon, north of Victoria Nyanza.
I have only seen the type of this beautiful little species.

14. *Teracolus eunoma.*

Pieris eunoma, Hopffer, Ber. Verh. Akad. Berl. 1855, p. 640; Peters's Reise n. Mossamb., Zool. v. p. 353, pl. xxiii. figs. 1, 2 (1862).

Querimba, Mozambique.
This is a wet-season form, and is not at all likely to be a mere variety of *T. chromiferus*, which also is a wet-season form occurring about 200 miles further northward. The species is only known to me at present through the admirable figure in Dr. Peters's work; but I am satisfied that it is just as distinct as *T. elgonensis*.

15. *Teracolus chromiferus.*

Teracolus chromiferus, Rothschild, Novit. Zool. vol. i. p. 538 (1894).

Most frequently received from Zanzibar, from which locality we have a pair from the Godman and Salvin collection; the example in Hewitson's collection is also from this locality. It, however, occurs southwards certainly as far as the Zambesi River, and, according to Marshall, even as far as Beira, whilst Dr. Ansorge obtained it in German East Africa.

16. *Teracolus puniceus.*

Teracolus puniceus, Butler, P. Z. S. 1888, p. 72, 1894, p. 573, pl. xxxvi. figs. 5, 6.

The wet-season form of this species has recently been received from Mni, near Mombasa; it is slightly larger than the typical dry-season form, and the magenta-red extends a little further along the costa, but not upon the outer margin; the veins above are more heavily blackened and terminate in black marginal dots; on the under surface the apex of primaries and the whole of secondaries are creamy buff, the costa of secondaries narrowly saffron-yellow towards the base, and the transverse ray is either absent or represented by black-brown dashes. The female is either white or bright yellow above, and greyish lavender or yellow, sparsely irrorated with greyish, below; the markings are somewhat similar to those of *T. hetæra*, but the borders perhaps rather less heavy, more nearly resembling the dry-season females of that species. *T. puniceus* ranges from Wadelai through the Victoria Nyanza south-eastward to Mombasa.

17. *Teracolus hetæra.*

♂. *Callosune hetæra*, Gerstaecker, Arch. für Naturgesch. 1871, i. p. 357; Van der Decken's Reisen in Ost-Africa, iv. 2, p. 365, pl. xv. fig. 2 (1873).

♀. *Teracolus foliaceus*, Butler, P. Z. S. 1894, p. 573, pl. xxxvi. fig. 7.

The range of *T. hetæra* appears to be from the Sabaki valley southwards to Zanzibar, meeting with *T. puniceus* at Mombasa only.

T. foliaceus is a dark form of the wet-season female; the dry-season male chiefly differs from that of the wet-season in the less-defined black veining and marginal dots and in the rosy under surface; the secondaries show faint traces of a transverse bar. A pair of this form was in the Godman and Salvin collection.

Mr. Marshall's supposition that *T. puniceus* would prove to be the dry-season form of *T. hetæra* is thus shown to be incorrect; personally I never accepted it as even a probability, for it is rare to find so great a difference in the character of the apical patch in this group of *Teracolus*.

18. *Teracolus Lorti.*

Teracolus Lorti, E. M. Sharpe, P. Z. S. 1896, p. 527.

This very distinct little species, of which the Museum at present possesses two males only, appears to be confined to Somaliland and Gallaland, the dry-season form only being known.

In *T. Lorti* the magenta apical patch reaches the greatest development, extending along the costal nervure to a point opposite to the upper extremity of the discoidal cell. This patch is not of the same colour as in the other species of the group, being duller and more lilacine in tint. The idea of this pretty little species being a variety of either *T. hetæra* or *T. puniceus* is quite out of the question.

19. *Teracolus regina.*

Anthocharis regina, Trimen, Trans. Ent. Soc. ser. 3, vol. i. p. 520 (1863).
Teracolus regina, Trimen, South Afr. Butt. iii. pl. xi. fig. 3 (1889).
Callosune anax, Grose Smith, Ann. & Mag. Nat. Hist. ser. 6, vol iii. p. 125 (1889); Rhop. Exot. i., *Call.* pl. i. figs. 5–8 (1889).
Teracolus eliza, E. M. Sharpe, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 441; Waterhouse, Aid Ident. Ins. pl. clxxxix. (1890).

The most northerly examples of this species were those obtained in the neighbourhood of the Albert Nyanza by the late Emin Pasha; thence it extends southwards along the eastern side of Africa through Nyasaland and the Zambesi district to the Transvaal *, and to the west it passes through the Bechuana country to Namaqualand and Damaraland. *T. anax* (=*eliza*) is the wet-season form.

20. *Teracolus imperator.*

Teracolus imperator, Butler, P. Z. S. 1876, p. 132.
Anthocharis ione, Reiche (not Godart), Ferret and Galinier, Voy. Abyss. pl. xxx. figs. 1, 2, 5–7 (1849).

The range of this species appears to be from Wasin Island through Zanzibar south-westwards, just touching Nyasaland,

* One of Hewitson's examples is even labelled as from Kaffirland, but this may be an error.

to the Transvaal; but the evidence of its occurrence in Nyasaland is based solely upon two female examples in the Hewitson cabinet, and it is well known that Hewitson attached so little value to the habitat of a species, that not much reliance can be placed upon his labelling. However, there is no reason why the distribution of this species should not run parallel to that of *T. phlegyas* through part of its range. That it is the same species, as urged by Mr. Marshall, I do not believe, for it differs both in its wet- and dry-season forms. The dry form of *T. imperator* has the purple apical belt narrower, with less black inner edging, and the under-surface colouring is mostly rosy, without transverse bar.

21. *Teracolus phlegyas.*

Anthocharis phlegyas, Butler, P. Z. S. 1865, p. 431, pl. xxv. figs. 3, 3*a*.
Euchloe coliagenes, Butler, Ann. & Mag. Nat. Hist. ser. 3, vol. xx. p. 216, pl. iv. figs. 4, 5 (1867).
Euchloe jalone, Butler, Cist. Ent. i. p. 14 (1869).

The types are all from the White Nile, and I am not at all sure that the larger and more heavily marked types which occur considerably further to the south ought not to be kept distinct from them; but until they have been bred it will, perhaps, be safer to regard them as mere local races of one widely distributed species. At the same time it is doubtful whether the species occurs all along the line from the White Nile to Nyasaland or thence southward to Delagoa Bay; and if a name had already been given to the more southern type, I should certainly have regarded it worthy of respect. As it is, there is so much general resemblance between the wet-season male from Nyasa and the dry-season male from the White Nile in the pattern and colouring of the upper surface, that I hesitate to insist upon keeping them separate.

Teracolus coliagenes, which Mr. Marshall regarded as linking the *T. eris* and *fausta* groups, is certainly nothing more nor less than the wet-season female of typical male *T. phlegyas*; the female which I described is the dry-season type, and therefore is that sex of *T. jalone*.

T. phlegyas, in all its forms, can be distinguished from *T. imperator* by its somewhat inferior size, the whitish scaling in spots upon the apical border of the males, and the transverse bar on the under surface of the secondaries usually more broken up. The females are much less heavily marked on the upper surface.

22. *Teracolus Buxtoni.*

Teracolus Buxtoni, Butler, P. Z. S. 1876, p. 130.
Callosune jalone, var. *natalensis*, Staudinger, Exot. Schmett. p. 44 (1888).

Natal.

The wet-season form of this local representative of *T. phlegyas* comes nearer to *T. ione*, only the male has a very strongly defined blackish stripe across the under surface of the secondaries; the female has the subapical white spots small and greyish in colouring and the basal area very dark, whilst the bar on the secondaries is more strongly marked and the spots of the marginal border extend further up the nervures. This is the *T. natalensis* of Staudinger *.

The dry-season form is represented by *T. Buxtoni*, of which we only possess a pair in the general series, but of which there are four others in the Hewitson collection. In this form the upper surface of the male resembles that of the wet-season type of *T. phlegyas*, but the female nearly approaches the dry-season form of the same.

23. *Teracolus ione.*

Pieris ione, Godart, Enc. Méth. ix. p. 140 (1819).
Anthocharis erone, Angas, Kaff. Ill. pl. xxx. fig. 3 (1849).
Anthopsyche speciosa, Wallengren, Lep. Rhop. Caffr. p. 16 (1857).
Euchloe jobina, Butler, Cist. Ent. i. p. 14 (1869).

I quite agree with Mr. Marshall that the argument used by my friend Mr. Trimen, that no Europeans lived in Natal when this species was described, is insufficient evidence to authorize the application of the name *T. ione* to a species which does not at all answer to M. Godart's description. This is the only species which can be correctly described as "anticis suprà apice (medio violaceo) nigris," which M. Godart further explains thus:—"Les premières ont à l'extrémité une bordure noire arquée, étroite vers l'angle interne, large vis-à-vis du sommet, où elle est divisée transversalement et obliquement par une bande violette, très-brillante, arrondie en dehors." The description of the under surface of the hind wings with "some blackish marginal dots" is not applicable to *T. jalone* or any of the forms of *T. phlegyas*, but only to

* This author, judging me by himself, makes some quite uncalled for remarks about *T. jalone* and *T. jobina*. Considering that I had three or four collections at my disposal when I described them, it would be odd if his statements were true.

this species and, in a less degree (sometimes), to *T. imperator*, and the single costal spot, which Godart does not specially mention, may easily have been reckoned by him as one of these marginal spots. Lastly, the white colouring of the under surface, upon which stress has been laid, is really of very little importance, for worn examples, or such as had been long on the wing, would show little if any yellow tinting. There is no accounting for the presence of many of the rare species which found their way into the collections of the older authors, often not to reappear for a hundred years or longer. As regards the argument as to Boisduval having seen M. Godart's type, it is evident, from what Mr. Trimen says, that the late Doctor confounded all the purple-tipped *Teracoli* together *. *T. jobina* is the dry-season form of the species, and the description was based upon four examples in the collection of Mr. Druce from Natal. These subsequently came into the possession of Messrs. Godman and Salvin, whose series of eleven specimens (inclusive of the above) is now in the Museum collection. An intermediate season form long represented *T. jobina* in the Museum, but three specimens in the Hewitson collection are typical.

24. *Teracolus bacchus.*

Teracolus bacchus, Butler, P. Z. S. 1888, p. 73; Grose Smith and Kirby, Rhop. Exot. i., *Call.* pl. i. figs. 1–4 (1889).
Callosune mrogoana, Vieillot, Bull. Soc. Ent. France, 1891, pp. ci and cxv.

Ranges from Lado, north of the Albert Nyanza, southwards to Mamboia and the Nguru hills, and eastwards to Kilima-njaro.

The wet-season form is characterized as distinct from *T. imperator* by its inferior size, the heavy black veining on both surfaces, the well-defined grey internervular spots on the apical border of the primaries in the male, and the rudimentary character of the transverse band on the under surface of the secondaries in that sex; it possesses also two forms of female, as is the case with *T. ione*. The dry-season male is somewhat larger, with the black veins much less defined above and almost or altogether wanting below, the black marginal spots also wanting on the upper surface of the

* This has been further proved by Mons. Dognin, who has kindly examined the original examples for me, but has been unable to decide which is the type of M. Godart's description, or even if it still exists in the series.

secondaries. Our two male examples of this form are not quite fresh, and therefore the colouring below is not very defined, but it does not seem ever to have been rosy. It is possible, therefore, that a still drier type may remain to be discovered.

[To be continued.]

BIBLIOGRAPHICAL NOTICES.

The Life-Histories of the British Marine Food-Fishes. By William Carmichael M'Intosh, F.R.S., Professor, and Arthur Thomas Masterman, Assistant Professor of Natural History in the University of St. Andrews. 8vo. London, 1897. Pp. xvi, 516. Frontispiece, 20 coloured plates, and 45 woodcuts.

St. Andrews (now "The Gatty"*) Marine Laboratory has distinctly forged ahead in the issue of this volume, which is alike creditable for its clear graphic style and excellence of illustration. It is just such a handbook as those interested in practical ichthyology—and particularly the new band of students at work in marine laboratories—should have at hand for easy reference and instruction. It will save much groping for literature scattered through many scientific journals &c., home and foreign—a kind of ready reckoner in its way. In the preface the authors specify their respective shares in the labour, the major part of which comprises records of work accomplished at "The Gatty" itself—and a goodly show it makes of "north of Tweed" fish science (*perfervidum ingenium Scotorum*).

Stress is justly laid on Sars's discovery of floating eggs—truly the starting-point of much of the subsequent ichthyological research. They remark how difficult it is "to predicate from the habits of a fish the nature of its eggs."

Three propositions are laid down with respect to the pelagic eggs. Their pelagic character:—(1) "leads to the dispersion of the species throughout the ocean"; (2) "tends to minimize the destruction of the eggs by any special agency"; (3) "appears to have played an important part in the preservation of the various food-fishes." The first result is due to the effects of oceanic currents and tides; the second to the relative invisibility of the eggs; and the third to the lengthening of spawning discharge and very numerous diminutive eggs. Howsoever these may be active agents, it nevertheless seems to us to follow that the essential differences, together with the greater fecundity of the pelagic, as contradistinguished from the

* In courtesy to Dr. Charles H. Gatty, whose handsome gift of a new building has infused fresh life to the institution.

demersal, type, are but safeguards against the enormous disadvantages of the buoyant habit. Not that there is a superiority in pelagic spawning, as one would infer from the authors' remarks.

Masterman reasons * that pelagic spawning is the more primitive form. To such argument there can be no positive answer, inasmuch as all depends whether marine or freshwater forms were first evolved—and this in our present state of knowledge is pure guesswork. Quite a number of ichthyologists are of opinion—and solid proofs are not wanting—that many freshwater forms readily adapt themselves to a salt-water habitat, and equally so the opposite. Nay more, examples are numerous and marked where, in the same fish, seasonal or part of every-day life, so to say, is spent in both waters. If *Amphioxus* be taken as the lowest piscine form (older view), or only as the progenitor through the hagfish and lamprey to the vertebrate true fish (later view), then, from what we know of their spawning-habits and littoral sojourning, there may be as great a chance that ground-spawning is the primitive mode.

Reference is made to Dannevig's observation that the pelagic eggs of certain forms are chiefly shed at night. To this we may add that even in the parturition of higher vertebrates the same holds good. It is averred that the number of floating eggs bears a ratio to the breeding fishes, with which axiom most would agree. As to their ruthless destruction and the intense after-struggle for existence, it would be hard to deny. To this is necessarily related, wherefore in the pelagic forms do females preponderate, the contrary obtaining in demersal forms? It certainly is remarkable that, say, the sprat and herring, so closely allied, should one be pelagic, the other demersal in habit; so that the adult structure evidently has no influence as a determining factor. Nor does oil-globule in the egg or size of the latter characterize a particular group of fishes, the closest allies again differing.

In the short chapter "Fish from a Pelagic Egg" it is shown that in most cases prior to and immediately after hatching the kind of fish can be recognized by its pigmentation. Some are of canary tint, others ruby-red, or stone-coloured, or black and yellow, or alone black-banded, these hues being only youthful stages in coloration. Some, again, have great post-larval fins or spines and such-like ornamentation, which are modified or lost as age advances. Woodcuts dispersed in the text represent several of these changes as cod, ling, &c., so that the eye is there and then impressed on the reading of the text. But this part of the subject is so replete with interest and suggestion, that this chapter could well have been expanded with figures accordingly. The authors deftly call attention to similar stages in the development of the higher vertebrates as indicating genetic relations with ancestral forms.

The topic of pelagic fauna is one on which M'Intosh himself has

* Here introduced, but *cf.* Brit. Assoc. Rep. 1896, reprinted in Nat. Science, 1897.

made some instructive observations in St. Andrews Bay. He carefully noted the faunal monthly changes for a year, eliciting that, winter or summer, swarms of plant and animal surface organisms abounded. May was the maximum, January the minimum, and June, July, and August high in pelagic life. His researches, comprising surface, mid-water, and ground fauna prevalent in the bay at stated periods, to a limited extent only corroborate those of the praiseworthy 'Plankton' Atlantic Expedition. The method employed by him, less minute and systematic, but nevertheless fairly satisfactory for practical purposes, differed from that of Hensen, and gave no warrant to this savant's mathematical apportionment and supposed uniformity of the 'Plankton': the essence of the former's research, derived from superficial, mid, and ground netting, tending rather to prove that trawling of inshore waters cannot deprive food-fishes of nourishment by rendering the sea-bottom barren, as some authors have asserted. Withal it truly corresponded to Haeckel's expression of a "Wonderland" in his 'Plankton Studien,' and rather sustains Haeckel's views of the continuous variation of the surface organisms monthly, daily, and even hourly; hence he arrives at a conclusion opposed to that of Hensen, viz. that rigid accuracy is out of the question in such a biological problem. Garstang at Plymouth and Peck in the United States have each essayed on the same lines as M'Intosh, and there is every promise, when our bays, inlets, and estuaries are better worked out, that some at least of the inshore fish migrations will be more thoroughly understood, and theoretical as well as practical results follow.

In the "General Sketch of Marine Teleostean Development" what Balfour did for Elasmobranchs has been done in the Teleosts, and is here given in "a brief and somewhat popular *résumé*," quoting the authors' own words. The same is chiefly based on M'Intosh and Prince's monograph (Trans. Roy. Soc. Edinb. 1890). The present authors have, as a rule, eliminated controversial discussion or reference to the special labours of others' investigations, limiting their treatment of the subject as much as possible to the presumed facts of the case as tolerably well agreed on. In this way they have given a succinct but unusually clear scientific account of the processes involved from fertilization to ultimate hatching and issue of the embryo onwards, through larval and post-larval conditions to adolescence. Therefrom the student can easily follow the changes step by step, and finish with definite ideas of the cell-division, origin of membranes and organs, whether derived from epiblast, mesoblast, or hypoblast. The whiting and cod are the types taken, with woodcuts, to illustrate the gradation of changes in their embryology.

The authors tell us "very little is definitely known in connexion with the rate of growth of food-fishes." This statement rather takes us aback, for we were of opinion that, as Cunningham puts it, "a considerable amount of evidence has been collected bearing upon the question of the growth of fishes." Are the researches of Fulton,

Holt, Meyer, Petersen, Cunningham, Tosh, Dannevig, Williamson, and of Masterman and M'Intosh themselves mere moonshine? We should be very sorry to think so, though willing to allow that all the piscine laws of growth are not irrevocably settled. The authors admit and enunciate that "a study of the average sizes of fishes shows that the annual increase is practically distinctly appreciable"; that the artificially reared grow at a slower rate; that cold retards growth; that the larger species of fishes have a greater rate of growth from the outset; and, lastly, that growth continues throughout life—which makes their statement as above appear somewhat contradictory.

Section II. of the volume, which occupies its larger bulk, is entirely devoted to "Life-Histories of the Species" of Teleosteans. It embodies, in fact, in a very readable form all that is known with certainty of this group up to date. Altogether 86 species are recorded. The life-histories of some of these are described very fully, and to others shorter notice is bestowed, namely, where there is paucity of data. There is still, therefore, plenty of material left, awaiting aspiring young naturalists and those in favoured positions, to deal with. A great share of the work has been performed at St. Andrews, though the Plymouth station renders an admirable quota. The results of foreign savants' labours, many of whom have had opportunities of studying rarer fish and their ova under favourable circumstances not always accorded to our home-bred investigators, are freely used; but all authorities at home and abroad are frankly acknowledged. Still a condensed Bibliography (such as that of Bashford Dean in 'Fishes Living and Fossil') would have been a boon to students. The writers evidently rely on the extensive list of authors and works previously given in the memoir Trans. Roy. Soc. Edinb.; but, then, the student may not possess this.

To one of the writers it is a highly satisfactory budget to comment on in the fact that since the late Lord Dalhousie's Royal Commission of 1883, when almost next to nothing was known of the life-history of British food-fish, to-day there is a bright galaxy of forms pretty well known, and that St. Andrews helped to that measure with a will.

It is premised that though the Gobiidæ, Gasterosteidæ, and certain other families are not food-fish in the ordinary sense, yet they are included as evidence of what is known in Teleost life-histories. Occasionally such humble members throw a ray of light on obscure points in other fish of much more importance economically. The material and treatment of the subject is somewhat after the under-mentioned fashion, varied of course according to what is known of the species &c.:—Whether the fish is a pelagic or demersal spawner; the number of ova; comparative sizes and number of females to males: times and places of spawning; aspect, diameter, and other particulars concerning the egg; period of incubation and the daily progress &c. in development; the larva and

postlarva, their inherent stages and changes, their wanderings, and so on; the further growth of the young fish, their habits, migration, food, &c.; sexual maturity and conditions respecting the adults; differences in development, habits, &c. of families and species of a genus, and other significant facts connected with their life-histories; besides matter of a kind affecting the fisheries—altogether a vast store of information.

What is denoted as "Ontogenic migration," that movement towards and from the shallow shores and estuaries again to deep water, of the larval and postlarval forms, and which is shared by several families, Pleuronectidæ included, is rather ingeniously indicated graphically in diagrams in the case of the lesser sand-eel and the herring. These both have a spring and autumn spawning-period, which overlap each other, and the young and older stages get mixed shorewise, so that it has been puzzling to ascertain their age and rate of growth. To these diagrams the Italian phrase *se non è vero è ben trovato* appears applicable.

In discussing Delage's discovery of the transformation of that curious form *Leptocephalus Morrisii* into a young conger, and the further observations of Grassi and Calandruccio on *L. brevirostris* in relation to the eel, our authors seem to throw cold water on the question. They boldly ask:—(*a*) What is the normal habitat of the *Leptocephali*, at least *L. brevirostris* and *L. Morrisii*? (*b*) Why are they not found in abundance on our coasts? (*c*) Do abnormal *Leptocephali* occur, or, indeed, is a Leptocephaline stage a normal part of the Muræenoid life-history at all? It is worth while remarking that Günther ('Study of Fishes') regards *L. Morrisii* as an abnormal larval condition of the conger, and he suggests that shore-spawning fish-ova through untoward circumstances hatched in mid-ocean may not develop or attain their normal growth.

But we have said enough to justify our preliminary remarks, that the St. Andrews volume is both interesting and likely to prove useful.

In only one sentence is a solitary plaint heard, for otherwise throughout the tone is cheerful and encouraging. It runs thus:—"The authorities entrusted with the patronage of posts in which marine zoology could be studied as a rule and with a singular impartiality [*sic*] filled them with those accustomed to other departments of the subject, while men imbued with enthusiasm for marine zoology are stationed far inland." The old story of the angular man stuck in the round hole. By-the-bye, was not that high-souled, most eminently gifted naturalist Louis Agassiz spurned the Edinburgh chair, when the authorities should have felt proud of his application? We believe even Darwin would have been refused on the same grounds given by the objectors. *Sic transit gloria mundi*!

Eggs of British Birds, with an Account of their Breeding-habits.—Limicolæ. With 54 Coloured Plates. By Frank Poynting. (R. H. Porter.)

Mr. Poynting is to be congratulated on the production of a work in which the illustrations are equal to those of Hewitson. We can hardly go further in the way of praise, for we have compared these plates with those of the Limicolæ in Hewitson's 1846 edition of the 'Eggs of British Birds,' undoubtedly the best in that respect, though the third edition (1856) contained additional figures of the eggs of about half a dozen Waders, mainly due to discoveries in Lapland by the late John Wolley. In the forty years which have elapsed increased facilities for travel and other circumstances have vastly increased our acquaintance with the nesting-haunts of many species, and where only a few specimens of eggs were available large series are now to be had. The opportunity has not been neglected, as shown by the figures of 6 eggs of the Cream-coloured Courser, 10 of the Grey Plover, 14 of the Little Stint, and 6 of the Bar-tailed Godwit; not to mention eggs more easily obtainable. Even the eggs of most of the wanderers from America are given, while, of the species which habitually visit our shores, only the Knot and the Curlew-Sandpiper remain without plates. The former of these species breeds in Arctic America, and the nestlings were obtained by the naturalists of the 'Alert' and the 'Discovery' on Grinnell Land in 1876, while General Greely, of the United States expedition, subsequently took from a female bird an egg apparently ready, or nearly ready, for extrusion; but this it would be premature to consider typical. The breeding-places of the Curlew-Sandpiper are probably on the extensive *tundras* of Arctic Siberia; and the natural difficulties in the way of reaching these are almost insuperable, except, perhaps, for an expedition subsidized by the Russian Government. Even while we write it is possible that Mr. H. J. Pearson and Col. H. W. Feilden may have been successful on their trip to Habarova this summer, though we hardly venture to anticipate such a result. The late Dr. von Middendorff obtained a female with a partially shelled egg in her oviduct on the Taimyr, in 74° N. lat., and that is the best up to the present.

A very strong feature of this admirable work is its text, which is largely compiled—with full acknowledgment—from authorities who have written from personal acquaintance with the various species or who have worked out their distribution. It is therefore, as the author says, "to a large extent a record of birds'-nesting adventures," and as such it cannot fail to be of interest to that very large class of ornithologists who, whatever be their age, are or have been birds'-nesters. For these the work is a compendium; it is, in fact, a history of the British Limicolæ at the most interesting period of their lives, without the descriptions of their plumage or of their behaviour during the cold season. The bibliography is well

chosen. One or two small oversights we notice; for instance, reference might have been made to Hewitson's figure of the egg of the Cream-coloured Courser—the first ever given—in 'The Ibis' for 1859, pl. ii. fig. 3; and with regard to Dann's communication to Yarrell respecting the nesting of the Broad-billed Sandpiper, the 1st edition of 'British Birds,' vol. ii. p. 639, and p. 642 (fig. of egg), should have been quoted rather than the 4th, in order to mark the early date of the discovery. On the whole, however, the work is as nearly perfect as any book can be, and, although necessarily costly, no ornithologist would willingly dispense with it. We are glad to hear that Mr. Poynting is preparing a similar work on the eggs of the British Raptores, and we trust that he may be further encouraged to give illustrations, with equally good letterpress, of the eggs of all the birds in the British List.

Trouessart's Catalogue of Mammals.

Catalogus Mammalium, tam Viventium quam Fossilium. By Dr. E. S. Trouessart. New Edition. Fasciculi I. and II., containing the Orders Primates, Prosimiæ, Chiroptera, Insectivora, Carnivora, Pinnipedia, and Rodentia (part). Berlin, 1897. 8vo. Friedländer and Son.

Stock-taking is an important operation in all trades, and in no case is it more urgently wanted than in Zoology, especially in Mammals. Few qualified zoologists would, however, care to undertake the enormous labour involved in the preparation of a systematic catalogue of all the known genera of Mammals, both recent and fossil; and the thanks of all interested in this particular branch of natural history are therefore due to the author of this *magnum opus*, who, it may be hoped, will enjoy the health and possess the patience and perseverance necessary to complete his self-imposed task.

With the changes that are daily taking place in our conceptions of zoological classification, and the perpetual emendations of nomenclature and descriptions of new forms that within the last few years have almost revolutionized the study of Mammals, and have rendered out of date almost every work on the subject before it has left the press, it cannot be expected that any sort of finality will be attached to the work before us. Indeed, although it is thoroughly well up to date, it may be observed that several important modifications have already been suggested in the classification of more than one group since the work went to press.

With the general scheme of classification adopted by Dr. Trouessart—that is, the division of the class into orders and families—we have no special concern, particularly as it is in the main that followed by most English writers on the subject. Of far more general interest are the author's modes of dealing with the burning questions of nomenclature, orthography, and the limitations of species and subspecies.

As regards the question of nomenclature, the author's views are not in all cases quite easy to understand, and his mode of procedure does not seem always uniform. Apparently he follows priority of date to the bitter end, as we find the little-known *Alouata* replacing the familiar *Mycetes*, and *Cynocephalus* giving way to *Papio*. But if priority is to cause the replacement of familiar names by others which have for years reposed in more or less deep obscurity, surely the preoccupation of titles is a much more serious bar to their employment. And yet in the Pteropidæ, or Pteropodidæ as we prefer to call them, we find the names *Megaloglossus* and *Macroglossus* retained, although they have been shown to be preoccupied and other names have been proposed in their place. On the other hand, *Anthropopithecus* replaces *Troglodytes*, on account of the preoccupation of the latter.

We presume the reason why *Megaloglossus* and *Macroglossus* are retained is because the preoccupying names have not precisely the same terminations—that is to say, because they end in *-glossa* or *-glossum* instead of *-glossus*. And this leads to the question whether a slight difference in the spelling of what is really the same word—either purposely or through ignorance—admits of its being used for two different genera: that is to say, whether we may have *Mastodon* and *Mastodus*, or *Megatherium* and *Megalotherium*. Until quite recently it was answered in the negative; but a school has been started which maintains that a name is always to be spelt precisely as written by the proposer, whether correct or not; and that if an author spells a name properly and assigns it to one genus, a second may spell it incorrectly and thus keep it for another. This is virtually a confirmation of the views of a certain West-Indian gentleman in one of Marryat's novels, who said that as individuals have peculiar styles of handwriting, there is no reason why they should not display idiosyncracies of spelling. In other words, it is the glorification of ignorance against education and culture. And we have heard it urged that as classical knowledge is likely to decrease, we cannot any more insist on classical accuracy in our scientific nomenclature. Our own opinion is very decided on the question; but it is quite time that naturalists in general should make up their minds once for all how the question is to be settled. And it is not the slightest use two or three saying that they will adopt such and such a plan without full consultation with all their fellow-workers.

What may be Dr. Trouessart's views on the question of amending orthography, it is quite impossible to determine. For instance, on page 137 we find the amended *Machærodus* standing for Kaup's original *Machairodus*, while on page 248 the incorrect *Ailurus* remains in place of the amended *Æluru*s. Possibly the question is one of not much moment one way or the other; but when it is a question of adopting the amended form or maintaining the original, it may be supposed that all will agree in advocating a uniformity of practice. Classically there is no doubt that if we use Latin

terminations to our scientific names we should follow Grimm's law in the substitution of Latin letters or diphthongs for their Greek equivalents, as, indeed, is universally done in our English version of the New Testament.

The mention of *Ailurus*, or *Æluru*s, brings to notice the circumstance that Dr. Trouessart places this genus—as represented by the Himalayan Panda—among the Bears, instead of with the Raccoons. And although its molar teeth do present a certain very curious similarity to those of the Parti-coloured Bear (*Æluropus*), yet the proposed innovation is, to say the least, open to a considerable amount of doubt. While on the subject of Bears, it may be noticed that the author (following Gray) places the Grizzly Bear in a subgenus apart from the Brown Bear; and yet there are naturalists who consider that both are but different local modifications of one and the same species! Another innovation which may be open to criticism is the placing of a number of extinct Lemuroids in the family Tarsiidæ, although recent observations as to the generalized characters of the living *Tarsius* may perhaps render it well-founded.

One more criticism and we have done. This relates to the so-called *Scomber scomber* principle, which, to our great personal regret—for it is too ridiculous and absurd—seems slowly but surely making its way among naturalists. Here, again, the author is not uniform in his treatment, for whereas we have *Gorilla gorilla* and *Lutra lutra*, we find *Meles taxus* in place of *Meles meles*.

It is in no carping or disparaging spirit that the above remarks are penned: the object of the reviewer being to urge how important it is for naturalists to come to some general agreement on the points mentioned. Before this can be done, every one must agree to submit his own individual views to the opinion of the majority and to adopt a spirit of give and take.

Dr. Trouessart's work will be of the highest value to all students of Mammals, and indeed absolutely indispensable to every worker in the subject. The care and precision with which it has been compiled, the fullness of the references, the extreme freedom from typographical errors, and the excellent style in which it is printed, render it alike creditable to the industry of the author and to the establishment of his publishers. R. L.

The Geology of the English Lake District, with Notes on the Minerals. By J. Postlethwaite, F.G.S. Small 8vo. 78 pages, with Illustrations. Bakewell, Keswick, 1897.

The Author, having lived in the Lake District and carefully studied the geology of Cumberland and Westmoreland for many years, has from time to time published several descriptive papers on the local rocks, their structure, minerals, and fossils. He now applies his geological and mineralogical experience to the production of this little book, in which he systematizes what has been observed

and published on the geology of this district. He indicates the various sources of his information and acknowledges the kind help of several friends.

The following rocks and strata are taken in succession:—1. The Skiddaw Slates and their Fossils, especially the Graptolites; together with some proposed new species of *Lingula*, viz. *L. Donaldi*, *Harknessi*, *Bonneyi*, *Derwentii* (if named after the Derwent Water it should have been *derwentensis*), *Marrii*, *Nicholsoni*, and *Howardi*. These and others are illustrated by more or less obscure figures after photographs. The Graptolites also are roughly lithographed, with some Trilobites. 2. The Volcanic Series of Borrowdale. 3. The Cross Fell Inlier. 4. The Drygill Shales. 5. Coniston Limestone Series. 6. The Granites of Eskdale, Shap, Skiddaw, and Enderdale. 7. Other special Igneous Rocks of St. John, Armboth, Little Knot, White House, Great Cockup, Sale Fell, Carrock Fell, Seatoller Fell, and Castlehead. 8. The Stockdale Shales. 9. Coniston Flags and Grits. 10. Bannisdale Shales and Kirkby Moor Flags. 11. Notes on the Carboniferous, Permian, and Triassic strata, including the Hilton Plant-beds. 12. Surface deposits, Old Lakes, Moraines, and Boulders. 13. Faults and Mineral Veins. 14. A Summary, sketching a geological history of the district from the time when the Skiddaw Slates were laid down as muddy shales and micaceous grits. Volcanic action and a general depression followed; and in time the Coniston Limestone and Shales were formed in a moderately deep sea. An upward movement then shallowed the sea and made an island of the district, which sank again to receive some Upper Silurian deposits, but was again raised and exposed to denudation for a long period, whilst the Old Red Sandstone was being formed elsewhere. Depression followed, and was accompanied by the production of the Carboniferous series. The Permian and Triassic marls and sandstones were subsequently accumulated in large salt-lakes, and, together with the rest of the region, after attaining a greater elevation, became subjected to long-continued subaërial denudation, partly effected by ice during the Glacial Period. Such great thicknesses of rocks and strata that have been here removed, and such enormous periods of time that must have been required in the operation, render it impossible to correctly calculate the interval of time between the origin of the Skiddaw Slates and the present condition of the Lake District in Cumberland and Westmoreland. The Author indicates about 23,000 feet of rocks as remaining now. 15. Of the local Minerals a hundred are enumerated, with their places of occurrence; and there are full descriptive notes for about twenty of them.

This little book will be useful to the intelligent tourist, with its succinct account of the rocks, minerals, and fossils of the district under notice, and with its many references to sources of further formation. Its illustrations, including a map, various fossils, and two geological sections, are well-intentioned, but too roughly drawn; and better editing would have much benefitted the book throughout.

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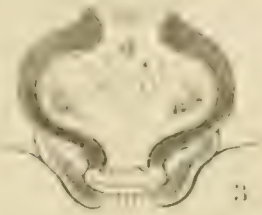
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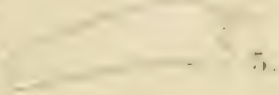
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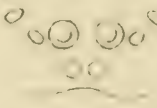
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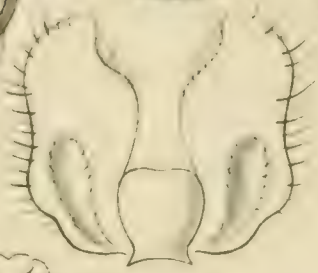
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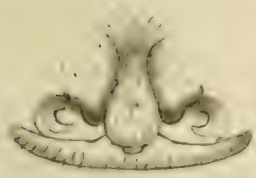
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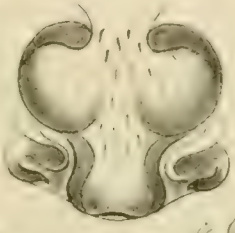
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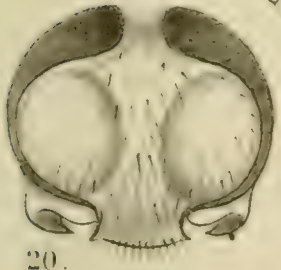
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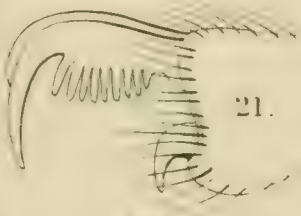
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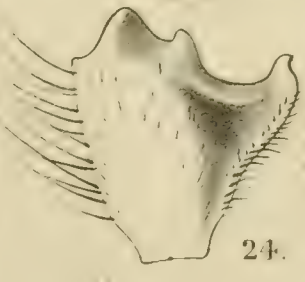
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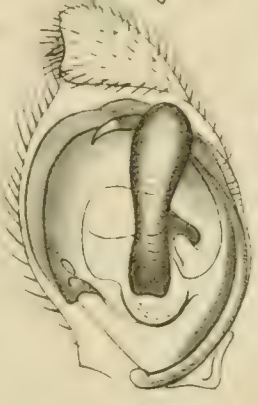
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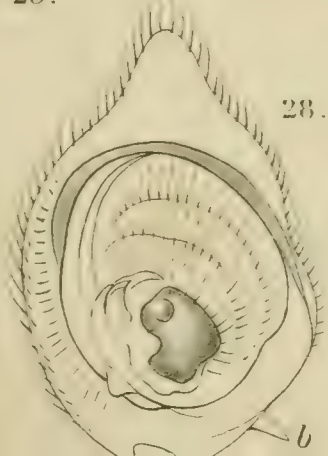
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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 119. NOVEMBER 1897.

XLVIII.—*On a Collection of Land-Shells from New Guinea.*

By EDGAR A. SMITH.

[Plate IX.]

THE specimens about to be enumerated and described were collected by Mr. W. Doherty chiefly at Kapaur, a mountainous region on the south-west coast of New Guinea, and at Takar, in the north-west of the island. The two forms of the new genus *Ditropopsis* and the new species of *Perrieria*, *Pupinella*, and *Adelomorpha* are especially interesting. All the specimens are in the National Collection.

Rhytida kapaurensis. (Pl. IX. figs. 1–3.)

Testa depressa, orbicularis, aperte umbilicata, tenuis, translucens, cornea, epidermide nitida, flavo-olivacea induta; spira depressa; anfractus 4, celeriter accrescentes, sutura profunda sejuncti, convexiusculi, lineis incrementi obliquis, arcuatis, prope suturam validis, sculpti, ultimus supra depresso declivis, antice subdescendens; apertura obliqua, late lunata; peristoma tenue, marginibus callo tenuissimo junctis, columellari vix reflexo.

Diam. maj. 16 millim., min. 13; alt. 7.

Hab. Kapaur.

Very closely related to *R. trobriandensis*, Smith, but rather more openly umbilicated, more strongly striated, with a deeper suture and a more oblique and differently shaped aperture.

Ariophanta (*Rhysota*) *Foullioyi* (Le Guillou).

Helix Foullioyi, Le Guillou, Rev. Zool. 1845, p. 187 ; Pfeiffer, Mon. Hel. vol. i. p. 44 ; Canefri, Ann. Mus. Stor. Nat. Genova, p. 149, pl. ii. figs. 1–3, as *Nanina*.

Hab. Kapaur (*Doherty*) ; Triton Bay (*Le Guillou*) ; Secaar, S.W. of New Guinea (*Canefri*).

The granulation of the upper surface of this shell terminates abruptly at the periphery, the lower half of the whorl being covered with a very glossy periostracum, marked with fine lines of growth and very fine concentric striæ. The aperture is livid purple-brown within, excepting the whitish base. The pale central zone is not very conspicuous in the specimen from Kapaur, and is situated just above the periphery.

Ariophanta (*Hemiplecta*) *divergens* (Brancsik).

Nanina (*Hemiplecta*) *divergens*, Brancsik, Jahresheft natur. Verein. Trencsén. Comit. 1894–5, p. 222, pl. v. figs. 4 *a–c* (1895).
Hemiplecta granigera, Ancey, Proc. Linn. Soc. N. S. W. vol. x. p. 378 (June 1895).

Hab. German New Guinea (*Brit. Mus.*) ; Astrolable Bay (*Brancsik*).

The specimen examined is apparently of a lighter colour than those previously described, the upper part of the spire being light brownish and the rest of the surface paler and clothed with a yellowish-olive epidermis. I am not quite sure which of the above names has priority.

Ariophanta (*Hemiplecta*) *andaiensis*, Smith, var. (Pl. IX. fig. 4.)

Ariophanta (*Hemiplecta*) *andaiensis*, Smith, Proc. Mal. Soc. vol. ii. no. 6.

Hab. Kapaur.

The specimens from this locality differ from the typical form from Andai in having the spire slightly less elevated and the keel more pronounced and compressed. *Nanina tritoniensis* of Le Guillou, as determined by Canefri, appears to be the same as this variety. The identification seems, however, somewhat doubtful, for the height (23 millim.) given by Le Guillou far exceeds that of the present form, taking into consideration the difference in diameter.

Trochonanina albolabiata. (Pl. IX. figs. 5–7.)

Testa conoideo-depressa, angustissime perforata, grisea, vel pallide cornea, subpellucida, acute carinata (carina compressa, prominente),

supra vix nitens, infra polita, lineis incrementi tenuibus obliquis striata; spira brevis, conoidea, ad apicem obtusa; anfractus $5\frac{1}{2}$, leviter convexiusculi, inferne ad carinam plane marginati, lente accrescentes, ultimus haud descendens, subtus convexus; apertura obliqua, lunata; peristoma intus incrassatum, album, margine superiore haud simplici, inferiore subexpanso, ad insertionem leviter reflexo.

Diam. maj. 11 millim., min. $9\frac{1}{2}$; alt. 6.

Hab. Kapaur.

T. Sturanyi of Brancsik is larger than this species, somewhat different in general form, and appears to have slightly flatter whorls.

Chloritis pervicina. (Pl. IX. figs. 8–10.)

Testa orbicularis, umbilicata, flavescens, rufo polyzonata, epidermide breviter hirsuta induta; spira valde concave depressa; anfractus 5, convexi, apicalis lævigatus, sequentes fortiter punctati, ultimus maximus, convexus, fere inflatus, antice oblique descendens; apertura lunata, sordide lilacea, obscure zonata; peristoma pallide lilaceum, margine columellari fere albo, conspicue sinuato, leviter incrassato et reflexo, superiore æque expanso.

Diam. maj. 28 millim., min. 23; alt. 15.

Hab. Kapaur.

Like *C. circumdata*, Férussac, in colour, but not so flat, the body-whorl being higher and more inflated. The spire is more deeply sunken and the punctation of the entire surface is quite different. In *C. circumdata* the apical whorls are coarsely punctate or granular, as in this species, but the rest of the shell exhibits only lines of growth and microscopic striæ across them. The red colour predominates above, the yellow on the under surface.

Albersia zonulata (Férussac).

Albersia zonulata, Férussac, Pilsbry, Man. Conch. ser. 2, vol. vii. p. 91, pl. xix. figs. 7, 8, var. fig. 6.

Hab. Kapaur.

The specimens from this locality belong to the variety *Recluziana*.

Planispira (*Cristigibba*) *moluccensis*, Pfr.

Planispira (*Cristigibba*) *semirasa*, Martens, Pilsbry, Man. Conch. ser. 2, vol. vi. p. 295, pl. xlvi. figs. 71–73.

Hab. Takar.

The banding of this species is subject to variation. The

typical form has two bands, one above and one below the middle. In a specimen in the Museum the lower band is wanting, and in the example from Takar there are three zones—a dark one around the periphery and two lighter brown ones above. In Herr Strubell's collection there is a form of this species from Batchian in the Moluccas. It consequently becomes a question whether the name *moluccensis* given by Pfeiffer should not be revived *.

Planispira (*Cristigibba*) *corniculum* (Hom. & Jacq.).

Planispira (*Cristigibba*) *corniculum*, Hom. & Jacq., Pilsbry, Man. Conch. ser. 2, vol. vi. p. 291, pl. xlvi. figs. 65–67.

Hab. Kapaur.

The specimens examined belong to the var. β of Tapparone Canefri, characterized by the rose-coloured peristome and a single blackish band upon the upper surface.

Papuina kapaurensis. (Pl. IX. figs. 11, 12.)

Testa depresse turbinata, umbilicata, pallide fulva, supra peripheriam zona saturate castanea cincta, infra suturam albo lineata; spira breviter conica, ad apicem mammillata; anfractus $5\frac{1}{2}$, superiores $2\frac{1}{2}$ convexi, cæteri planiusculi, oblique striati, ultimus ad peripheriam vel rotunde vel acute carinatus, vix descendens; apertura pallide purpureo-albida in medio unizonata; peristoma album, superne late expansum, marginibus columellari et inferiore latissime expansis et reflexis.

Diam. maj. 44 millim., min. 35; alt. 25.

Hab. Kapaur.

Perhaps only a variety of *P. lituus*, Lesson, or of *P. labium*, Férussac, differing in the sharper angulation and flatter whorls. *P. Bevani*, Hedley, belongs to the same group.

Papuina Tayloriana (Ad. & Reeve).

Papuina Tayloriana, Ad. & Reeve, Pilsbry, Man. Conch. ser. 2, vol. vii. p. 58, pl. xvii. figs. 40, 41, pl. ii. figs. 20, 21, 27.

Hab. Takar.

The beautiful specimens from this locality closely approach the type as regards form, but differ in colour. The zones (four or five both above and below) are much darker and more defined, and the upper whorls are blackish purple, but more or less pale beneath the suture.

* *Vide* Smith, Proc. Malac. Soc. vol. ii. p. 120.

Papuina aurora (Pfeiffer).

Papuina aurora, Pfeiffer, Pilsbry, Man. Conch. ser. 2, vol. vii. p. 41.

Hab. Kapaur (*Doherty*); Islands of Sorong and Ramoi (*Canefri*); Waigiou (*Wallace*).

The specimen from Kapaur agrees precisely with the type of the species in size, colour, form, and sculpture.

Papuina lacteolota, Smith, var.

Papuina lacteolota, Smith, var., Pilsbry, *op. cit.* vol. vii. p. 25.

Hab. Kurudu, East of Jobi, New Guinea (*Doherty*).

This variety is smaller than the type, has a narrower body-whorl, fewer dark bands, and very little of the milky cloudiness upon them. There are five zones on the body-whorl, and of these two revolve up the spire.

Papuina plurizonata (Ad. & Reeve).

Helix plurizonata, Ad. & Rve., Voy. 'Samarang,' p. 62, pl. xvi. fig. 9.

Hab. Takar, north-west of New Guinea (*Doherty*).

The original locality assigned to this species—namely, Mindanao, Philippines—is evidently an error, and has never been confirmed. The specimen collected at Takar is almost identical in form and colour with the type in the Museum collection. The latter has a hole in the last whorl behind the lip, as if it had been threaded and attached to something. If it really was brought from Mindanao, it is quite certain that it must have been taken there by human agency.

Papuina Hedleyi (Smith).

Helix (*Geotrochus*) *Hedleyi*, Smith, Journ. of Conch. vol. vii. p. 72 (1892).

Helix (*Geotrochus*) *Canefriana* (Dohrn, MSS.), Kobelt, Conch.-Cab ed. 2, p. 708, pl. ccii. figs. 1, 2 (1894).

Hab. Kapaur, S.W. New Guinea (*Doherty*).

This species appears to be rather variable in colour. The type has the base uniformly dark chestnut-brown, the rest of the shell being yellowish buff, excepting a fine opaque luteous line upon the keel which revolves up the spire and a narrow dark brown zone beneath the suture. The aperture is whitish within and the peristome tinged with dark brown at the edge.

A specimen collected by Mr. Doherty has a similar style of coloration, but the colours are all intensified, the base being darker, the keel orange, the peristome broadly margined with

black, and the spire of a darker tint, becoming purplish towards the apex, with a black infrasutural line and traces of a whitish periostracum forming oblique streaks in the direction of the lines of growth, more or less interrupted by fine spiral lines. This epidermal ornamentation is referred to by Kobelt.

Other specimens (var. *concolor*, nov.) are of a uniform whitish colour beneath the pale greenish-yellow or ochraceous periostracum, and the peristome is margined with pinkish purple-brown or purple-black. All specimens appear to have a white tooth-like prominence or thickening on the columella.

Papuina Blanfordiana (H. Adams).

Papuina Blanfordiana, H. Adams, Pilsbry, *op. cit.* vol. vii. p. 26, pl. xvii. fig. 33.

Hab. Kapaur.

Calycia crystallina (Reeve).

Bulimus crystallinus, Reeve, Conch. Icon. vol. v. pl. xxxii. fig. 194.
Calycia crystallina, Canefri, Ann. Mus. Stor. Nat. Genova, vol. xix. p. 100.

Hab. Kapaur.

Opeas oparanus (Pfeiffer).

Bulimus oparanus, Pfr., Proc. Zool. Soc. 1846, p. 34; Monog. Hel. vol. ii. p. 158; Reeve, Conch. Icon. vol. v. fig. 646.

Hab. Kapaur (*Doherty*); Island of Opara (*Pfeiffer*); Louisiade Archipelago and Madagascar (*Brit. Mus.*).

Perrieria minor. (Pl. IX. fig. 13.)

Testa sinistrorsa, elongata, cylindracea, epidermide tenui virescenti-flavescente induta; spira longissima, truncata; anfractus superstantes 7, lente accrescentes, leviter convexi, oblique striati, infra suturam subplicati, sutura valde declivi subcrenulata impressa sejuncti, ultimus antice subascendens; apertura subauriformis, intus pallide lilacea; peristoma pallidum, continuum, leviter incrassatum, antice paulo expansum; columella subcontorta, vix truncata.

Longit. 36 millim., diam. 8; apertura 9 longa, 5 lata.

Hab. Kapaur.

Much smaller than *P. clausiliæformis* of Canefri, of a thinner texture, having finer sculpture, a differently coloured periostracum, and a less truncate columella.

Cyclotus (*Pseudocyclophorus*) *canaliculatus*, Möllendorff.

Cyclotus (*Pseudocyclophorus*) *canaliculatus*, Möllendorff, Proc. Malac. Soc. vol. i. p. 238, pl. xv. figs. 8, 8*a*.

Hab. Kapaur and Takar.

The type figured appears to have been either somewhat young or else a small example of the species, for those in the present collection are considerably larger, having a diameter of 22 millim. In some specimens an infra-peripheral colour-zone is more or less observable, and those from Takar have the spire rather more depressed than the typical form. The species (?) is probably a form of *C. distomellus*, Sow., in which the outer margin of the peristome is less developed than in normal examples.

Leptopoma callichloros, Canefri.

Leptopoma callichloros, Tapparone Canefri, Ann. Mus. Stor. Nat. Genova, vol. xxiv. p. 178, pl. ii. figs. 16, 17.

Hab. Kapaur.

The slightly more elevated and conical spire and the broadly and flatly expanded peristome are the features which separate this form from *L. vitreum*. Perhaps it is hardly sufficiently distinct to deserve specific rank. The type is described as "ochraceo-fulvida," but some specimens are ornamented with numerous fine spiral lines. One example is purplish red, spirally lineated, and has the peristome of an intensely black tint.

Lagochilus papuanus. (Pl. IX. figs. 14–16.)

Testa aperte umbilicata, depresse turbinata, lutescens, maculis rufis supra radiantibus infra subundulatis ornata, periostraco plus minus setoso induta; spira brevis, subconcave conica, ad apicem mammillata; anfractus 5, convexi, apicales duo nigro-purpurei, læves, cæteri lineis incrementi obliquis arcuatis aliisque spiralibus decussatis sculpti, ultimus ad peripheriam carinatus et breviter ciliatus, antice paulisper descendens; apertura fere circularis; peristoma pallidum vel lilaceum, vix expansum, intus incrassatum, sed ad marginem tenue, superne ad suturam distincte incisum.
Diam. maj. $9\frac{1}{2}$ millim., min. 8; alt. $6\frac{1}{2}$.

Hab. Kapaur.

This and *L. Poirierii* of Canefri are the only species belonging to this genus as yet known from New Guinea. The spiral lines above the periphery are coarser than those beneath, and the lines of growth are well marked by epidermal threads.

Adelomorpha Canefriana. (Pl. IX. figs. 17, 18.)

Testa turbinata, anguste umbilicata, pallide rufescens, tenuissime spiraliter striata; anfractus 5, perconvexi, ultimus rotundatus, antice vix descendens; apertura subcircularis, intus dilute rufescens; peristoma simplex, tenue, haud expansum, pallidum, margine columellari obliquo, fere rectilineare, leviter incrassato, superiore prope suturam prominente. Operculum calcareum, extus valde concavum, album, anfractibus 5, utrinque carinatis, transversim fortiter striatis, sutura canaliculata sejunctis, infra luteum, lineis numerosis tenuibus, curvatis, radiantibus, griseis ornatum, margine externo trisulcato et carinato.

Diam. maj. $7\frac{1}{2}$ millim., min. 6; alt. 8.

Hab. Kapaur.

Larger and more globose than *A. tunicata*, Canefri, and also readily distinguishable by its remarkable operculum.

Adelomorpha globosa. (Pl. IX. fig. 19.)

Testa turbinato-globosa, anguste umbilicata, sordide lutescens, spiraliter tenuissime striata; anfractus 5, perconvexi, sutura profunda sejuncti, ultimus globulosus, antice vix descendens; apertura subcircularis; peristoma tenue, simplex, acutum, pallidum, margine columellari subincrassato, vix reflexo. Operculum calcareum, album, extus concavum, anfractibus quinque lineis incrementi tenuissimis striatis.

Diam. maj. 5 millim., min. $4\frac{1}{3}$; alt. $4\frac{1}{2}$.

Hab. Kapaur.

It differs from *A. Canefriana* in its smaller size, less elevated spire, deeper suture and operculum. *A. tunicata* appears to have a similar operculum, but the shell is very different in form.

Ditropopsis papuana, gen. et sp. n.
(Pl. IX. figs. 20–23.)

Testa depressa, orbicularis, carinata, lato et perspective umbilicata, olivaceo-cornea, nitens, semipellucida; spira convexa, depressa; anfractus normales $3\frac{1}{2}$, convexiusculi, ad suturam carino-marginati, ultimus haud descendens, ad medium et circum umbilicum carina acuta, definita, valde prominente, pallida instructus; umbilicus infundibuliformis, spiraliter liratus et carinatus, epidermide tenui, striata, indutus; apertura irregulariter pentagona, parva; peristoma leviter incrassatum et expansum, intus ad carinas canaliculatum, haud continuum, marginibus callo tenuissimo junctis. Operculum corneum, circulare, extus rufo-fuscum,

concavum, parte prominente conica, cava, in medio instructum, subtus convexum, flavescens, gyros 4–5 exhibens.
Diam. maj. $4\frac{1}{4}$ millim., min. $3\frac{7}{8}$; alt. $2\frac{1}{3}$.

Hab. Kapaur.

The shells of this genus closely resemble certain forms of *Ditropis* (e. g. *D. planorbis*, Blanford), which comprises about twenty-two species from Africa, India, Borneo, Java, Sulu Islands, Amboina, Haruku, Fitzroy Island, N.E. Australia, and the Philippine Islands. Those from the last locality have been associated with it on conchological characters only, the opercula being either unknown or undescribed. The peculiarity in the operculum distinguishes the present genus from *Ditropis*. Perhaps *Ditropis spiralis* of Boettger, from Haruku Island, also belongs to *Ditropopsis*. Probably very few of the so-called species of *Ditropis* found outside India have the precisely typical operculum of that genus. It really becomes a question whether these differences of structure in the operculum are of more than specific importance.

The upper part of the spire of this interesting species has the appearance of being segmented within the whorls. What the cause of this remarkable partitioning may be could only be ascertained by more or less destroying one of the few specimens at present known.

Ditropopsis (?) *Fultoni*. (Pl. IX. figs. 24–26.)

Testa conica, perspective umbilicata, pellucida, albida, cornea, nitens; anfractus $4\frac{1}{2}$, apicales 1–2 (nucleus) vitrei, convexi, haud carinati, excentrici, soluti, apicem spiræ haud claudentes, cæteri convexi, in medio angulati et plus minus carinati, inferne ad suturam carino-marginati, striis incrementi tenuissimis sculpti, ultimus ad peripheriam carina acuta, lata, compressa, et altera circa umbilicum instructus, haud descendens; spira conica, tabulata, ad apicem perforata; apertura rotundata, ad carinas angulata; peristoma intus incrassatum, plus minus duplex, marginibus callo tenui junctis, supero et inferiore leviter expansis, ad carinas subcanaliculatis. Operculum ignotum.
Diam. maj. 3 millim., min. $2\frac{1}{2}$; alt. $2\frac{1}{3}$.

Hab. Kapaur.

Ditropis ingenua, Bœttger, from North Amboina, has the apex of the spire very similar to that of this species, but the operculum is not that of *Ditropopsis*. I have much pleasure in naming this species after Mr. Hugh Fulton, who has kindly submitted it to me for examination.

Diplommatina symmetrica, Hedley. (Pl. IX. fig. 27.)

Diplommatina symmetrica, Hedley, Proc. Linn. Soc. N. S. W. 1891, vol. vi. p. 107, pl. xii. fig. 39.

Hab. Kapaur (*Doherty*) ; Basilaki Island (*Hedley*).

The spiral striæ between the fine oblique lamellæ are excessively fine and only discernible under a compound microscope. The double lip is badly depicted in Mr. Hedley's figure. The inner margin is thickened and not continuous, and of a reddish colour, the outer being thin, expanded, paler, and united above by a thin callus. Outside this lip is a second strong lamella.

Diplommatina papuana. (Pl. IX. figs. 28, 29.)

Testa sinistrorsa, imperforata, ovato-acuminata, flavescens, ad apicem rufescens, vel purpureo-fusca ; anfractus 6, perconvexi, apicales duo læves, cæteri costellis obliquis arcuatis tenuibus numerosis instructi, et microscopice spiraliter striati, penultimus inflatus, ultimum latitudine æquans, ultimus supra aperturam constrictus, antice ascendens : apertura obliqua, irregulariter ovata ; peristoma aurantiacum, duplex, margine interno incrassato, haud continuo, dente columellari minuto instructo, externo tenui, expanso, callo tenuissimo continuo, pone lamella altera valida munito.

Longit. 3 millim., lat. 2 ; apertura cum perist. $1\frac{1}{3}$ lata.

Hab. Kapaur.

Seen from behind the penultimate whorl is large and conspicuously tumid.

Palaina Dohertyi. (Pl. IX. figs. 30, 31.)

Testa sinistrorsa, imperforata, elongata, turrita, sordide albida, ad apicem fusco-cornea ; spira elongata, ad apicem obtusa ; anfractus 7, convexi, apicales duo læves, cæteri lamellis obliquis tenuibus instructi, penultimus ultimo conspicue latior, ultimus antice ascendens ; apertura circularis, alba ; peristoma pallidum, latissime plane expansum, margine interno continuo, externo interrupto.

Longit. 3 millim., diam. $1\frac{1}{2}$; apertura cum perist. $1\frac{1}{3}$ lata.

Hab. Kapaur.

Under a compound microscope spiral striæ between the lamellæ are discernible. The flat expanded peristome is finely concentrically striated.

Palaina novoguineensis. (Pl. IX. figs. 32, 33.)

Testa dextrorsa, ovata, imperforata, flavescens; anfractus 6, perconvexi, superiores 1–2 læves, cæteri costulis obliquis tenuissimis instructi, ultimus supra aperturam constrictus et gibbosus, penultimo minor, antice valde ascendens, penultimus inflatus, magnus; apertura circularis, flavescens; peristoma subduplex, intus incrassatum, margine interiore continuo, externo expanso, tenui, supra aperturam interrupto.

Longit. 4 millim., diam. $2\frac{1}{2}$; apertura cum perist. 2 lata.

Hab. Kapaur.

The fine riblets on the third and fourth whorls are rather further apart than those on the two last.

Callianella Wallacei (Pfeiffer).

Callia Wallacei, Pfr., Proc. Zool. Soc. 1862, p. 117, p. xii. fig. 1; Monog. Pneumon. vol. iii. p. 98; Sowerby, Thesaurus, vol. iii. pl. cclxv. figs. 7, 8.

Pupina (*Callia*) *Wallacei*, Martens, Preuss. Exped. Ost-Asien, p. 158, pl. iv. fig. 12.

Hab. Kapaur, New Guinea (*Doherty*); Ceram, Amboina, and Buru.

The two specimens from Kapaur agree in every particular with the types from Ceram, excepting that they look the least trifle shorter.

Pupinella Hedleyi. (Pl. IX. fig. 34.)

Testa subovata, superne acuminata, rufa; spira convexe conica; anfractus $6\frac{1}{2}$, convexiusculi, lineis incrementi obliquis tenuibus striati, penultimus ultimum latitudine æquans, ultimus oblique descendens, supra aperturam vix planatus; apertura circularis, intus rufa; peristoma pallide carneum, incrassatum, margine dextro valde reflexo, supra producto et sinuato, columellari infra oblique fissurato, supra calloso, callo labrum versus dente conspicuo terminato.

Longit. 11 millim., diam. 6; apertura intus $2\frac{2}{3}$ lata.

Hab. Kapaur.

This species differs from *P. Strubelli*, Smith, and *P. Fultoni*, Smith, in form, colour, and in having a distinct upper labral sinus. In the last respect and general appearance it more resembles *P. mindorensis*, Adams and Reeve. Named after Mr. Charles Hedley, of the Australian Museum, Sydney.

Helicina leucostoma, Canefri.

Helicina leucostoma, Canefri, Ann. Mus. Stor. Nat. Genova, 1883, vol. xix. p. 277, fig. *h*.

Hab. Kapaur.

Two specimens, agreeing in all respects with the figure and description excepting the colour of the lip. In one reddish example it is pale yellow and in the other it is yellow like the rest of the shell. The species approximates very closely to *H. modesta*, Pfr., from the New Hebrides and Solomon Islands.

EXPLANATION OF PLATE IX.

Figs. 1–3. *Rhytida kapaurensis.*
Fig. 4. *Ariophanta* (*Hemiplecta*) *andaiensis.*
Figs. 5–7. *Trochonanina albolabiata.*
Figs. 8–10. *Chloritis pervicina.*
Figs. 11, 12. *Papuina kapaurensis.*
Fig. 13. *Perrieria minor.*
Figs. 14–16. *Lagochilus papuanus.*
Figs. 17, 18. *Adelomorpha Canefriana.*
Fig. 19. *Adelomorpha globosa.*
Figs. 20–23. *Ditropopsis papuana.*
Figs. 24–26. *Ditropopsis* (?) *Fultoni.*
Fig. 27. *Diplommatina symmetrica.*
Figs. 28, 29. *Diplommatina papuana.*
Figs. 30, 31. *Palaina Dohertyi.*
Figs. 32, 33. *Palaina novoguineensis.*
Fig. 34. *Pupinella Hedleyi.*

XLIX.—*Descriptions of new Fishes from the Mekran Coast, Persia.* By G. A. Boulenger, F.R.S.

The new Fishes described in this note have been presented to the British Museum by Mr. F. W. Townsend, who obtained them on the Mekran coast of Persia during recent cable-repairing operations.

Anthias Townsendi.

Depth of body equal to length of head, $3\frac{1}{5}$ times in total length. Snout convex, scaly, $\frac{1}{2}$ diameter of eye, which is 3 times in length of head and slightly exceeds interorbital width; lower jaw projecting, naked; maxillary scaly, extending to below centre of eye, the width of its distal extremity $\frac{1}{2}$ diameter of eye; serræ at angle of præopercle enlarged; two opercular spines. Gill-rakers long and closely set, about 30 on lower part of anterior arch. Dorsal X 16; originating

above opercular cleft: first and second spines shortest, third longest, nearly ½ length of head, and produced in a short filament; no notch between spinous and soft portions; posterior soft rays longest, ½ length of head. Pectoral ¾ length of head, as long as ventral; latter reaching vent. Anal III 7; second spine longest, nearly ½ length of head. Caudal with crescentic emargination. Caudal peduncle as long as deep. Scales 43 $\frac{2-3}{15}$; lateral line 41, gently curved. Uniform reddish.

Total length 85 millim.

A single specimen.

Pseudochromis nigrovittatus.

Depth of body 5 times in total length, length of head 4 times. Snout as long as diameter of eye, which is 4 times in length of head and slightly exceeds interorbital width; maxillary extending to below anterior third of eye; 6 series of small scales on the cheek; large scales on the opercle. Dorsal II 28; soft rays ⅔ length of head. Pectoral ⅔ length of head, as long as ventral. Anal II 15. Caudal trifurcate, outer lobes longest. Caudal peduncle as long as deep. Scales 53 $\frac{2}{13}$; lat. l. $\frac{33-35}{10}$. Olive-brown above, yellowish white beneath; a black stripe on each side, from the tip of the snout, through the eye, to the middle caudal rays; fins yellowish.

Total length 80 millim.

Two specimens.

Gobius Townsendi.

Both jaws with strong canines. Depth of body equal to length of head, 3⅗ to 4 times in total length. Head naked, longer than deep and deeper than broad; lower jaw projecting beyond upper; maxillary extending to below anterior fourth of eye; snout extremely short, hardly ½ diameter of eye, which is ⅖ length of head; interorbital region very narrow; a deep groove between and behind the eyes. Dorsal VI 11; first dorsal nearer the end of the snout than the base of the caudal; longest rays of second dorsal about ½ length of head. Anal 11, opposite to soft dorsal. Ventral nearly reaching vent. Caudal rounded. Caudal peduncle a little longer than deep. Scales 40–45; 15 or 16 in a transverse series. Pinkish above, with faint brown dorsal cross-bars, which are more distinct on the nape; a small blackish spot above the upper border of the gill-cover; fins colourless.

Total length 30 millim.

Several specimens.

Salarias curtus.

A strong canine on each side of the lower jaw. Depth of body equal to length of head, $3\frac{1}{2}$ to $3\frac{3}{4}$ times in total length. Head nearly as deep as long; profile of snout descending nearly vertically; diameter of eye $\frac{1}{4}$ length of head and double interorbital width; a short nasal tentacle; a very long fringed supraocular tentacle, measuring $\frac{1}{3}$ to $\frac{2}{5}$ length of head; maxillary extending to below centre of eye; no cephalic crest. Dorsal XII 19, not notched, longest rays $\frac{1}{2}$ length of head, originating on occiput, well in advance of opercular cleft. Anal 20. Dorsal and anal narrowly separated from caudal, which is rounded and measures $\frac{3}{5}$ length of head. Flesh-colour, minutely speckled with dark brown, with more or less distinct dark spots confluent into 7 or 8 paired dorsal cross-streaks; a dark blotch behind and an oblique streak below the eye; vertical fins greyish, dorsal sometimes with dark spots, prolongations of the bars on the body.

Total length 60 millim.

Several specimens.

Salarias phantasticus.

No canines. Depth of body equal to length of head, 5 times in total length. Head a little longer than deep; profile of snout descending vertically; diameter of eye $\frac{1}{4}$ length of head and $1\frac{1}{2}$ interorbital width; a long nasal tentacle, equalling the diameter of the eye; no supraocular tentacle; no cephalic crest; maxillary extending to below centre of eye. Dorsal XII 19, with a shallow notch; longest rays in anterior portion, equal to length of head; dorsal originating above opercular cleft. Anal 23. Dorsal and anal nearly reaching caudal, the outer rays of which are produced and exceed length of head. Head and anterior half of body dark brown; posterior half of body orange, with eight vertical black bars; fins yellowish.

Total length 75 millim.

Two specimens.

L.—*Descriptions of new Fishes from the Upper Congo.*—II.*

By G. A. Boulenger, F.R.S.

The Fishes here described were obtained at Stanley Falls by Mr. Bentley. They are preserved in the British Museum.

Pelmatochromis congicus.

Three series of teeth in both jaws. Depth of body $2\frac{1}{4}$ times

* *Cf.* 'Annals,' vol. xvii. 1896, p. 309.

in total length, length of head $2\frac{3}{4}$ times. Snout as long as diameter of eye, which is $3\frac{2}{3}$ in length of head and equals interorbital width; maxillary extending to below anterior third of eye; 4 series of scales on the cheek; opercle naked (?). Gill-rakers long and slender, about 20 on lower part of anterior arch. Dorsal XIII 11; spines subequal from the sixth, nearly $\frac{1}{2}$ length of head and $\frac{2}{3}$ longest soft rays, which are produced and filiform. Pectoral as long as head. Ventral with produced outer rays, reaching anal spines. Anal III 8; third spine as long as and stronger than longest dorsal spine. Caudal rounded. Caudal peduncle a little deeper than long. Scales cycloid, 30 $\frac{4}{11}$; lat. l. $\frac{21}{10}$. Olive, with yellowish spots occupying the centres of the scales; a rather indistinct dark lateral streak; vertical fins blackish, with round yellow spots.

Total length 175 millim.

A single specimen.

Synodontis pleurops.

Præmaxillary teeth in 6 transverse series; mandibular teeth 17, uncinate, simple, measuring $\frac{1}{2}$ diameter of eye, forming a small fascicle; no posterior villiform mandibular teeth. Depth of body equal to length of head, 4 times in total length. Head little longer than broad, flat on the crown; snout triangular, broader than long; eye perfectly lateral, just visible from below as well as from above, its diameter $1\frac{2}{3}$ in length of snout, $3\frac{1}{2}$ in length of head, $2\frac{1}{2}$ in interorbital width. Gill-cleft very narrow, not extending below base of pectoral. Maxillary barbels small, simple, hardly reaching base of pectoral; mandibular barbels fringed, outer twice as long as median and half as long as maxillaries. Dorsal II 7; spine not serrated. Adipose fin small, $\frac{1}{2}$ length of head, shorter than its distance from the dorsal. Humeral process simply granulate, obtusely pointed, not extending quite as far as the occipito-nuchal shield, which is $1\frac{1}{3}$ as long as broad and does not extend beyond the first soft ray of the dorsal. Anal IV 8. Caudal deeply bifurcate. Skin smooth. Brown above, whitish beneath; fins greyish white, with a blackish stripe along each lobe of the caudal.

Total length 170 millim.

A single specimen.

Prof. L. Vaillant has recently published a monograph of this genus (Nouv. Arch. du Mus. (3) vii. & viii. 1895–96). Eight species are recorded by him from the Congo basin, and may be distinguished, together with the one now added, by means of the following synopsis :—

I. Slender mandibular teeth 35 or more; posterior villiform mandibular teeth present.
A. About 60 slender mandibular teeth; maxillary barbel reaching extremity of pectoral ..... *S. Afro-Fischeri*, Hilg.
B. 35–45 slender mandibular teeth.
1. Maxillary barbel reaching beyond extremity of pectoral spine ..... *S. Greshoffi*, Schilth.
2. Maxillary barbel not extending beyond middle of pectoral spine.
Humeral process not extending beyond occipito-nuchal shield ..... *S. angelica*, Schilth.
Humeral process extending beyond occipito-nuchal shield ..... *S. omias*, Gthr.

II. Slender mandibular teeth not more than 25.
A. Posterior villiform mandibular teeth present; 16–25 slender mandibular teeth; maxillary barbel reaching middle of pectoral spine..... *S. schall*, Bl. Schn.
B. No posterior villiform mandibular teeth.
1. 15–25 slender mandibular teeth.
a. Eyes sublateral, well visible from above.
Maxillary barbel reaching caudal fin ..... *S. Alberti*, Schilth.
Maxillary barbel reaching middle of pectoral spine ..... *S. notatus*, Vaill.
b. Eyes perfectly lateral, just visible from above as well as from below; maxillary barbel not reaching beyond base of pectoral ..... *S. pleurops*, Blgr.
2. Not more than 10 slender mandibular teeth; maxillary barbel not reaching base of pectoral ..... *S. Vaillanti*, Blgr.*

Citharinus congicus.

Depth of body twice in total length, length of head $3\frac{1}{2}$ times. Snout very short and broad, a little shorter than diameter of eye, which is $3\frac{2}{3}$ times in length of head and $1\frac{1}{2}$ in interorbital width; free border of opercle forming nearly a right angle; a much-developed membranaceous border to the opercle. Dorsal 18, originating a little nearer base of caudal than end of snout; fourth ray $1\frac{1}{3}$ length of head. Base of adipose fin $\frac{2}{5}$ base of dorsal. Pectoral $\frac{2}{3}$ length of head, reaching base of ventral. Ventral equally long, reaching

* *S. labeo*, Vaill., nec Gthr.—Günther's *S. labeo* differs in the longer maxillary barbel, reaching anterior third of pectoral spine; the shorter humeral process, which extends only to below the middle of the occipito-nuchal shield; and the longer adipose fin, which equals nearly twice its distance from the dorsal. Another difference, in the distance between ventral and anal, has been pointed out by Vaillant himself.

vent. Anal 30. Caudal deeply forked. Scales 60 $\frac{5}{17}$; 13 scales between lateral line and base of ventral. Uniform silvery.

Total length 205 millim.

A single specimen.

Closely allied to *C. Geoffroyi*, Cuv. Distinguished by larger scales.

Distichodus sexfasciatus.

Two series of teeth in the jaws; 14 teeth in the outer series in both jaws. Depth of body $2\frac{2}{5}$ times in total length, length of head 4 times. Snout as long as deep, $1\frac{3}{4}$ as long as diameter of eye, which is 4 times in length of head and $1\frac{1}{2}$ in interorbital width; snout slightly projecting beyond the mouth, which extends to below nostrils; interorbital region convex. Dorsal 24, originating a little nearer the base of the caudal than the end of the snout; longest rays as long as head. Pectoral as long as head to præopercular border. Ventrals equally long, reaching vent. Anal 13. Caudal forked, with rounded lobes. Caudal peduncle $1\frac{1}{2}$ as deep as long. Scales strongly ciliated, 65 $\frac{15}{15}$; lat. l. 63. Reddish, with 6 black vertical bands, a little narrower than their interspaces, the first on the nape, the third below the origin of the dorsal, the sixth on the caudal peduncle; dorsal fin with small round blackish spots; adipose fin blackish.

Total length 70 millim.

A single specimen.

Distichodus leptorhynchus.

Two series of teeth in the jaws; 14 teeth in the outer series of the upper jaw, 12 in the lower. Depth of body equal to length of head, $3\frac{1}{4}$ times in total length. Snout longer than deep, $1\frac{1}{2}$ as long as diameter of eye, which is 4 times in length of head and equals interorbital width; mouth terminal, not extending to below nostrils; interorbital space flat. Dorsal 25, originating a little nearer the base of the caudal than the end of the snout. Pectoral $\frac{3}{5}$ length of head. Ventral equally long, reaching vent. Anal 13. Caudal forked, with rounded lobes. Caudal peduncle as long as deep. Scales strongly ciliated, 70 $\frac{12}{15}$; lat. l. 66. Yellowish, with 7 blackish vertical bands, much narrower than their interspaces, the first on the nape, the third below the origin of the dorsal, the sixth below

the adipose fin, the seventh on the caudal peduncle; dorsal and adipose fins blackish.

Total length 115 millim.

A single specimen.

Mormyrus Bentleyi.

Depth of body equal to length of head, 5 times in total length. Snout short, moderately curved, twice diameter of eye, $\frac{1}{4}$ length of head; mouth terminal, on a line with lower border of eye, its width $\frac{1}{5}$ length of head; teeth moderately large, notched, 7 in the upper jaw, 10 in the lower; chin strongly swollen; diameter of eye 8 times in length of head. Dorsal 23, originating halfway between the gill-opening and the caudal and above the sixth ray of the anal; longest rays $\frac{1}{2}$ length of head. Pectoral nearly as long as head, extending beyond base of ventral; latter not quite $\frac{1}{2}$ length of head. Anal 34; longest rays $\frac{3}{5}$ length of head. Depth of caudal peduncle $\frac{1}{3}$ its length. Scales 58 $\frac{8}{12}$; 12 scales round caudal peduncle. Dark olive.

Total length 270 millim.

A single specimen.

Mormyrus Stanleyanus.

Depth of body $3\frac{3}{4}$ times in total length, length of head 5 times. Snout short, moderately curved, $1\frac{1}{2}$ diameter of eye, $\frac{1}{3}$ length of head, $\frac{2}{3}$ interorbital width; mouth terminal, on a line with centre of eye, its width $\frac{1}{5}$ length of head; teeth moderately large, not notched, 7 in the upper jaw, 6 in the lower; chin strongly swollen; diameter of eye 5 times in length of head. Dorsal 28, originating halfway between the gill-opening and the caudal and above the ninth ray of the anal; longest rays a little more than $\frac{1}{2}$ length of head. Pectoral a little shorter than head, reaching base of ventral; latter $\frac{2}{5}$ length of head. Anal 37; longest rays a little more than $\frac{1}{2}$ length of head. Depth of caudal peduncle $\frac{1}{3}$ its length. Scales 80 $\frac{15}{15}$; 12 scales round caudal peduncle. Silvery, dark grey on the back.

Total length 210 millim.

A single specimen.

Allied to *M. cyprinoides*, L., which differs in the more convex snout, the smaller eye, and in the number (16) of scales round the caudal peduncle.

Mormyrus psittacus.

Depth of body $3\frac{1}{2}$ times in total length, length of head $4\frac{1}{2}$ times. Snout very short, strongly curved, hardly as long as diameter of eye, which is $4\frac{1}{2}$ times in length of head; mouth terminal, below the level of the eye, its width $\frac{1}{5}$ length of head; teeth moderately large, notched, 3 in the upper jaw, 4 in the lower; chin slightly swollen. Dorsal 33, originating halfway between end of snout and caudal and considerably in advance of anal; longest rays $\frac{3}{5}$ length of head. Pectoral a little shorter than head, reaching base of ventral; latter $\frac{1}{2}$ length of head. Anal 23, originating below thirteenth dorsal ray; longest rays $\frac{2}{3}$ length of head. Depth of caudal peduncle $\frac{1}{3}$ its length. Scales 60 $\frac{12}{13}$; 12 scales round caudal peduncle. Silvery, dark grey on the back.

Total length 125 millim.

A single specimen.

This species is probably the same as *M. discorhynchus*, Schilthuis (nec Peters). *M. discorhynchus* differs in the snout projecting beyond the mouth, the smaller scales (65–70 $\frac{15}{15}$), and the deeper caudal peduncle (2–$2\frac{1}{2}$ as long as deep).

LI.—*New Genera and Species of Millipedes of the Family* Platyrrhachidæ *from the Indo- and Austro-Malayan Sub-regions, contained in the Collection of the British Museum.*

By R. I. Pocock.

Most of the material upon which this paper is based has been acquired by the Trustees of the British Museum, during the past ten years, from various collectors, like Messrs. C. Hose, A. Everett, and H. N. Ridley, who are resident in the East and have kindly forwarded the specimens to the Museum in response to an appeal for examples of Millipedes.

A few of the species here described as new may eventually prove to be identical with species established by Peters in 1864. But without examination of the types the identification of Peters's species is almost impossible, owing to the absence of figures and to the fact, recently established by Mr. Cook, that in many cases the diagnoses were based upon two or more recognizable forms *.

* On behalf of collectors unfamiliar with the taxonomy of the Diplopoda, it may be explained that the Platyrrhachidæ are for the most part Millipedes of large or medium size, in which the body is composed of twenty segments, each segment, except the first and the last, being furnished on each side with a large more or less square and horizontal plate which bears the pore.

Genus Phyodesmus, Cook.

Phyodesmus, Cook, Brandtia, i. p. 1 (1896).

Phyodesmus ornatus, sp. n. (Fig. 1, p. 431.)

♂.—*Colour* (in alcohol) of dorsal surface bluish grey, the middle of the back yellowish green; the cylindrical part of the segments with a broad blackish blotch on each side, separated by a triangular paler portion; keel-bearing portion of segments furnished with two or three black spots on each side in front and a few more behind; at the end of the body these spots show a tendency to fuse and form continuous dark bands; pores black; antennæ and legs blackish.

Length of *antennæ* excelling width of first tergite by about half its own width, less than width of second.

First tergite with its angles produced, the anterior border straight between them. Second segment about as wide as the twelfth. The anterior seven segments with merely lobulate side margins, the rest with two or three distinct though short triangular teeth; anterior border of keels convex, with rounded basal shoulders, posterior border lightly sinuous, both smooth. *Pore* on fifth and seventh segments about three diameters from the edge, on the toothed keels not more than two diameters from the notch. *Caudal process* posteriorly narrowed, posterior border straight but laterally notched.

Copulatory foot (as in fig. 1) straight, ending in a shorter blade-like ramus and a longer curved prong, from which projects a smaller lamina.

Measurements in millimetres.—Total length 100; width of second segment 14·5, of fifth 16, of twelfth 14·8.

Loc. Borneo (*Rev. G. Brown*).

Phyodesmus Hosei, sp. n. (Fig. 2.)

♂.—Resembling the preceding, but bluer in colour, without yellowish-green dorsum, and the black patches on the cylindrical part of the segments separated by a narrower pale band.

Keels also considerably larger, with the teeth much stronger, appearing as far forwards as the fifth segment; on the posterior segments long and sharp, the pore being often quite close to the adjacent notch.

Copulatory foot much longer, the long prong broader at the base, the short ensiform process much shorter and not projecting as straight forwards.

Measurements in millimetres.—Total length (at least) 96; width of second segment 15, of fifth 17·7, of twelfth 16.

Loc. Baram, Borneo (*C. Hose*).

Phyodesmus vittatus, sp. n. (Fig. 3.)

♂.—*Colour* (dry and faded) a tolerably uniform pale brown, but with a distinct continuous narrow pale band passing along the middle of the dorsum from the first to the nineteenth segments.

First tergite with its angles scarcely produced.

Body not so wide anteriorly as in the preceding two species, the fifth segment being only a little narrower than those situated more posteriorly; the keels more elevated from the base and the whole of the dorsal surface more coarsely granular; lateral margins of keels dentate from the fifth backwards; the teeth from two to four in number, not including the anterior and posterior angles. *Pore* about two diameters from the edge on the fifth and seventh segments; about one or less from the adjacent notch on the posterior segments. Sternal spines much longer than in the preceding two species.

Copulatory foot (as in fig. 3) long, straightish, ending in two unequal prongs, the longer strongly curved and slender, the shorter more laminate and abruptly hooked.

Measurements in millimetres.—Total length 93 (at least); width of second segment 13·8, of fifth 15, of twelfth 14·3.

Loc. Borneo (*H.M.S.* '*Samarang*').

This species belongs doubtfully to the genus *Phyodesmus*, being apparently more coarsely granular than the type (*P. pictus*, Peters), with the anterior angles of the first tergite not produced to anything like the same extent. Either of the other species here referred to *Phyodesmus* may prove to be identical with *pictus*, Pet., *Petersii*, Cook, or *montrado*, Cook, which have not yet been satisfactorily diagnosed.

Phyodesmus areatus, sp. n.

♀.—*Colour* (dry and faded specimen) greyish brown; cylindrical half of segments blackish above, with a median pale band; keel-bearing portion paler in the middle, with three blotches in front on each side, also some brown spots posteriorly, the spots separated by whitish lines, which form a kind of pale network pattern. Anterior angles of first tergite produced. Dorsal surface of all the segments distinctly granular, the rows of tubercles distinct.

Side margins of the keels from about the eighth distinctly dentate, but the teeth all small, about four in number not including the anterior and posterior angles, so that the pores never come close to the nearest notch, being usually separated by about two diameters from it; on the fifth segment the

pores are about three diameters from the edge; posterior margin of posterior keels finely serrulate.

Sternal spines longish. Coxæ of second leg produced into a long spiniform process.

Measurements in millimetres.—Total length 96; width of second segment 13·5, of fifth 17, of twelfth 16·3.

Loc. Borneo (44·106).

This form may prove to be the female of *P. ornatus,* but the teeth on the margins of the keels are smaller and more numerous, the dorsal surface is far more coarsely granular &c., the anterior borders of the keels less convex &c.

The development of the coxal processes on the second leg may be a generic character.

Stenoniodes, gen. nov.

Anterior end of the *body* normally attenuate, the second segment much narrower than the fifth.

First tergite carinate, broad in front, the anterior border of the keel on a level with that of the rest of the tergite.

Antennæ short in both sexes, the length less than the width of the second tergite.

Tergites granular or coriaceous, with three rows of tubercles distinct but not strong; keels large, horizontal; anterior and posterior margins entire, lateral border at most sinuate, base of the keel elevated into a rounded prominence nearly on a level with the summit of the back. *Pores* far removed from the side margin of the keel; anterior and posterior angles of keels rounded, not in any sense spiniform: only in the segments posterior to the sixteenth do the posterior borders of the keels project distinctly backwards.

Caudal process with convex posterior border and rounded angles.

Sterna with two pairs of longish spines; the anterior pair divided downwards and forwards, the posterior pair vertically downwards.

Copulatory feet of male short, terminating in two subequal prongs.

Type *S. Catorii.*

This genus resembles *Phyodesmus* in the form of its first tergite, which either has the anterior angles produced or is broadest along the anterior margin; but the lateral margins of the keels are only lightly sinuate, not deeply toothed as in *Phyodesmus.* In the position of the anterior sternal spines it approaches *Phractodesmus,* but the latter has the posterior sternal spines directed backwards, not vertically downwards,

the pores close to (about one diameter from) the edge, the first tergite without produced or widely rounded front keels, &c.

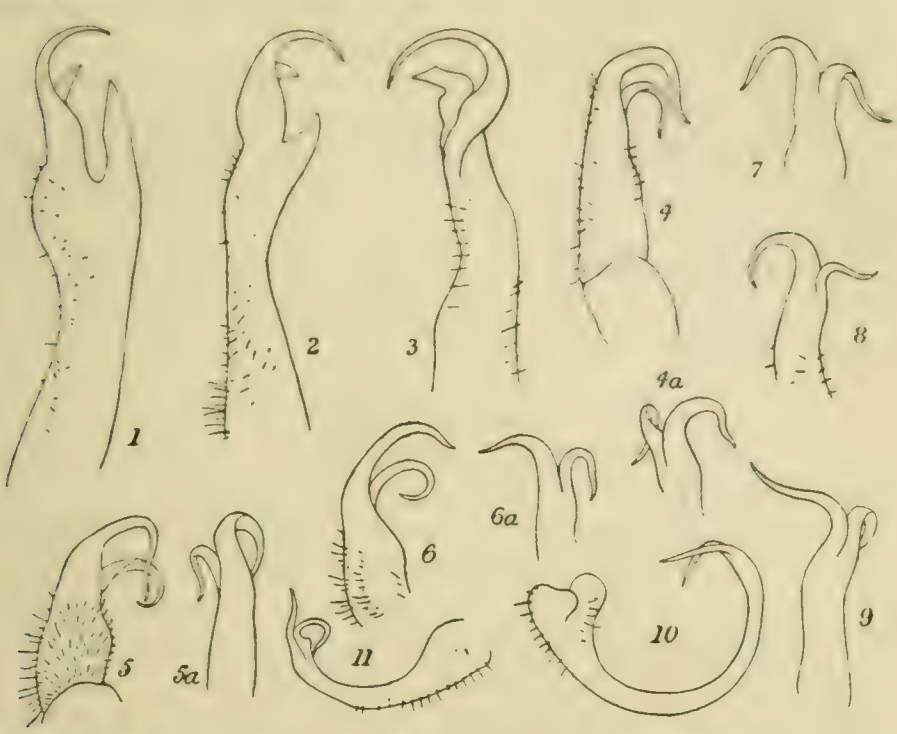


Fig. 1.—*Phyodesmus ornatus.* Left copulatory foot; outer view.
Fig. 2.—*Phyodesmus Hosei.* Ditto.
Fig. 3.—*Phyodesmus vittatus.* Right copulatory foot; outer view.
Fig. 4.—*Stenoniodes Catorii.* Left copulatory foot; outer view.
Fig. 4 *a*.—Ditto. Apex of copulatory foot from below.
Fig. 5.—*Stenoniodes Creaghii.* Left copulatory foot; outer view.
Fig. 5 *a*.—Ditto. Ditto from below.
Fig. 6.—*Acanthodesmus pinangensis.* Left copulatory foot; outer view.
Fig. 6 *a*.—Ditto. Right copulatory foot from below.
Fig. 7.—*Acanthodesmus perakensis.* Ditto.
Fig. 8.—*Acanthodesmus Petersii.* Ditto.
Fig. 9.—*Acanthodesmus lineatus.* Ditto.
Fig. 10.—*Eurydirorhachis dulitensis.* Right copulatory foot; outer view.
Fig. 11.—*Eurydirorhachis discrepans.* Left ditto.

Stenoniodes Catorii. (Figg. 4, 4 *a*.)

♂.—*Colour* of segments a uniform purplish black, only the three borders of the keels yellowish white; head, antennæ, and legs blackish; sterna and bases of legs ochre-brown.

First tergite granular, with an anterior marginal row of beads, its anterior border straight, keels not or hardly elevated; the following three segments granular above, the following segments merely coriaceous, granular on the keels; the prominence at the base of the keels conspicuous and sculptured like the dorsum, being coriaceous; keels wider

than dorsum of segments, their anterior borders convex, but not sharply shouldered at base; posterior border also lightly convex, at all events at the base, where in the posterior half of the body it is distinctly shouldered. *Pores* about six diameters from the lateral margin of the keels.

Copulatory foot (as in fig. 4, 4 *a*), when viewed from below, ending in two prongs, one above the other at the base, whence they diverge, the inferior prong curving upwards, outwards, and backwards, the superior upwards, inwards, and backwards.

Measurements in millimetres.—Total length 78, width 15·5; width of second segment 11·3, of fifth 15·5.

Loc. Sandakan (*D. Cator*).

Stenoniodes angulicollis, sp. n.

♂.—Closely allied to *S. Catorii*, but not so black in colour, being browner.

Keels of the first segment more elevated, projecting forwards, so that the anterior border between them is distinctly concave.

Prominence at the base of the keels on the other segments low and relatively but little noticeable as compared to *Catorii*.

Copulatory feet practically as in *Catorii*.

Measurements in millimetres.—Total length 73; width of second tergite 10·5, of fifth 15·2.

♀.—Larger than male and more convex, with smaller keels, those of the first tergite not being produced.

Measurements in millimetres.—Total length 80; width of fifth segment 17, of caudal process 4.

Loc. Sandakan (*D. Cator*).

Stenoniodes Creaghii, sp. n. (Figg. 5, 5 *a*, p. 431.)

Smaller than *Catorii*, but very closely resembling it in colour (except that the white border on the keels is broader, being distinctly traceable on the first tergite) and structure, the tergites presenting the same smooth prominence at the base of the keels; the keels, however, of the first tergite are distinctly more produced, though not so much as in *angulicollis*; and the copulatory organ is shorter, with the prongs a little differently disposed, as shown in figg. 5, 5 *a*.

Measurements in millimetres.—Total length 67; width of second tergite 11, of fifth 13.

♀.—Like the male in colour; rather more granular than the female of *angulicollis*, the anterior rows of tubercles being distinct on all the tergites.

Measurements in millimetres.—Total length 69; width of fifth segment 13·5, of caudal process 3·5.

Loc. North Borneo, Sandakan coast (*Governor Creagh*).

This species is smaller than the preceding two, is rather more coarsely granular, and has the edges of the keels more broadly whitened.

Stenoniodes baluensis, sp. n.

Colour black, with the white margins to the keels conspicuous as in *Creaghii*, with the same form of first tergite but with coarser granulation, the two anterior rows of tubercles being distinct on all the segments and the tergites even at the end of the body distinctly, though finely granular; lastly, the tail is narrower than in the other species, with side margins that are straight and parallel, with angles more squared.

Measurements in millimetres.—Total length 92; width of fifth segment 17·5, of caudal process 3·6.

Loc. Mount Kina Balu (*J. Whitehead*).

Stenoniodes sibutensis, sp. n.

♂.—*Colour* a very deep chocolate-brown or black; margins of keels with a strong red tinge, the coloured rim also broader than in the other species.

First tergite with its anterior angles not produced in front of the anterior border; the rest of the tergites and upperside of keels more coarsely granular; elevation at the base of the keel not very conspicuous, and not smoother than the rest of the keel; lateral borders of keels more strongly lobulate than in the other species. *Copulatory feet* short as in *Creaghii*, but with the prongs shorter and curled almost as they are in *Catorii*.

Measurements in millimetres.—Total length 64; width of second segment 9·5, of fifth 12·5, of caudal process 3·2.

Loc. Sibutu Island, Sulu Archipelago (*A. Everett*).

Genus Acanthodesmus, Peters.

Acanthodesmus, Peters, Mon. Ak. Wiss. Berlin, 1864, pp. 546–547.

Acanthodesmus pinangensis, sp. n. (Figg. 6, 6 *a*.)

Smaller than *Andersonii* and differently coloured.

♂.—*Colour.* Dorsal surface a blackish or reddish brown, the base of the keels the same tint as the dorsum of the segment, the rest of the keels a dull brownish yellow; lateral portions of first and second segments not yellow, of third only slightly so; legs and antennæ distally infuscate.

Sterna and *coxæ* pale yellow.

Dorsum of posterior segments coriaceous, not granular, upperside of keels granular; margins of keels lobulate, straight; pore about a diameter and a half from the edge. Caudal process with its margin less convex than in *Andersonii*.

Copulatory organ with the prongs differently curved, the inner being bent more abruptly backwards and the outer less abruptly backwards.

Measurements in millimetres.—Total length 64; width of second segment 8·2, of fifth 10.

Loc. Pinang (*H. N. Ridley*).

Acanthodesmus perakensis, sp. n. (Fig. 7, p. 431.)

As large as *Andersonii*, but differently coloured and more coarsely sculptured.

Legs and antennæ flavous as in that species; dorsum of keel-bearing portion of segments brown, lateral portions on base of keel noticeably darker, the rest of the keel flavous; cylindrical area of segments dorsally pale brownish yellow with a median black band.

Dorsal surface of all the segments, even at the end of the body, very distinctly granular, more so than in *Andersonii*.

Copulatory organ with practically the same curvature of prongs as in *Andersonii*.

Measurements in millimetres.—♂ (small). Total length 68; width of fifth segment 10. ♀. Total length 82; width of fifth segment 13.

Loc. Perak. Specimens presented by J. H. Leech, Esq.

Acanthodesmus Petersii, sp. n. (Fig. 8.)

♂.—*Colour* faded, apparently as in *perakensis*, but the keels without indication of a black basal patch, as much yellow on them as in *Andersonii*, the cylindrical part with traces of a median dark line. But apart from its colouring, which is of doubtful value, seeing that the specimen is faded, the species certainly differs from both *Andersonii* and *perakensis* in the form of the copulatory foot, the inner prong of which is not bent backwards but inwards, then slightly forwards at the tip.

Measurements in millimetres.—Total length 72; width of fifth segment 10.

Loc. Malay Peninsula (*Ind. Mus.*).

Acanthodesmus lineatus, sp. n. (Fig. 9.)

♂.—*Colour* black, the edges of the keels very narrowly bordered with pale yellow and a narrow (1 mm. wide) longitudinal dorsal band extending from the upper surface of

the head to the base of the last segment; sterna and bases of legs pale; antennæ and legs ochraceo-fuscous.

Antennæ long, as wide as the third segment, less than the ninth by half the width of the keel.

Dorsal surface finely granular or coriaceous, the tubercles not very distinct; keels large and nearly horizontal, with anterior and posterior borders finely serrulate and lateral margin almost entire; only finely sinuous on the posterior keels; anterior angles strongly convex, anterior border also convex, with rounded basal shoulder; posterior border angulate basally, lightly concave; posterior angle acute, shortly spiniform; pores about three diameters from the edge.

Caudal process very wide, rather strongly notched just before its posterior angles; the middle of its posterior surface widely produced.

Copulatory feet with the external prong directed downwards and outwards, the lower or inner prong curved almost vertically upwards and backwards.

Measurements in millimetres.—Total length 54; width of second segment 7·8, of fifth 9·5.

Loc. Singapore (*H. N. Ridley*).

This species differs from the preceding in the presence of a median dorsal yellow band, the small amount of yellow on the keels, the greater distance of the pore from the margin, its larger keels and longer antennæ.

Eurydirorhachis, gen. nov.

Antennæ short, a trifle exceeding the width of the first tergite.

Body very wide in front, owing to the large size of the anterior keels, which resemble in shape and approximately in size those of the rest of the body, the second segment being as wide across as the seventeenth or sixteenth; first tergite with its angles not produced forwards, but widest just behind the anterior border.

Tergites coarsely granular, tubercles distinct; keels with anterior and posterior borders finely serrulate; lateral margin lobulate, fluted, the pore remote from it; anterior border basally shouldered, angle rounded, posterior angle square or acute, but not spiniform; from the fifteenth segment the keels project posteriorly beyond the level of the posterior border of the tergite.

Caudal process very wide, widest at its posterior angles.

Sterna with four short spines directed posteriorly.

Copulatory organ long, curved, ending in two short subequal prongs.

Differing from *Acanthodesmus* and allied genera by the large size of the keels of the second and third segments, especially of the second.

Eurydirorhachis dulitensis, sp. n. (Fig. 10, p. 441.)

Colour black, the lateral margin and anterior and posterior angles of the keels ochre-yellow, but only at the hinder end of the body does the yellow extend inwards and involve the pore; first tergite and caudal process scarcely noticeably yellow; antennæ blackish; legs fulvo-fuscous, with paler basal segments.

Dorsal surface of segments coarsely granular on anterior half of body, less coarsely posteriorly, but the rows of tubercles distinct on all of them; margins of the keels indistinctly four or five lobate; the posterior border basally indistinctly angulate. Pores situated about two or three diameters from the lateral border, but farther away from it in the posterior than in the anterior half of the body.

Copulatory feet as in fig. 10; distal segment thick and hairy at base, then suddenly narrowed and running out into a long strongly arched smooth ramus, curved upwards and backwards and ending in two short subequal prongs.

Measurements in millimetres.—♀. Total length 83; width of fifth segment 15, of second 13·6.

Loc. Mount Dulit, N. Borneo (*C. Hose*).

Eurydirorhachis baramensis, sp. n.

♀.—Resembling the preceding, but with the keels more flavous, the yellow even in the anterior half of the body extending as far as the pore, while the first tergite has its side margins very distinctly flavous and nearly the whole of the caudal process is pale; the legs and antennæ also are paler. Keels a little larger.

Measurements in millimetres.—Total length 82; width of fifth segment 15·5, of second 13·5.

Loc. Baram, N. Borneo (*C. Hose*).

Eurydirorhachis discrepans, sp. n. (Fig. 11.)

♂.—*Colour* (dry) a uniform chocolate-brown, the yellow on the keels (if any) being not distinctly indicated except on the first segment, where it is very visible. Closely related to the preceding species, but with the side margins of the keels much more distinctly lobulate, the lobules on the poste-

rior half of the body taking the form of smooth rounded teeth or tubercles.

Copulatory feet (as in fig. 11) much shorter and less curved than in *dulitensis*, with the inner terminal flagellum angled at the base and strongly curled.

Measurements in millimetres.—Total length 65; width of fifth segment 11·5, of second 11.

Loc. Borneo.

HOPLURORHACHIS, gen. nov.

First tergite broadest in front of the middle, but the anterior angles not produced.

Dorsal surface of segments finely granular or coarsely coriaceous; the three rows of tubercles visible, the posterior the largest; margins of keels entire; pores remote from the margin.

Caudal process broad, posteriorly strongly tridentate, the lateral angles and the middle being strongly produced.

Sterna from seventh segment armed with four long posteriorly or downwardly directed spines.

Distal end of copulatory organ shorter than hairy basal ramus, bent at right angles to it and trifid.

Type *H. Everettii.*

Differing from allied genera (*Acanthodesmus* &c.) in having the lateral angles of the caudal process produced and spiniform.

Hoplurorhachis Everettii, sp. n. (Figg. 12, 12 *a*, p. 441.)

Colour black or deep brown, the dark colour spreading on to the keels at least as far as the pore; the rest of the keels and legs and antennæ and the processes of the tail flavous.

Length of *antennæ* a little less than width of second segment.

Anterior end of body rapidly increasing in width posteriorly from the first to the fifth segments.

Anterior border of *keels* (*e. g.* of twelfth segment) thickened, shouldered basally, anterior angle rectangularly rounded; posterior border finely crenulate, the angle subacute, a triangular prominence at the base; pore separated from the lateral margin by at least four diameters; posterior border of this keel on a line with the posterior border of the segment; tail narrow, with prominent processes.

Copulatory foot with straight basal ramus; terminal portion broad, giving off internally a wide short lamina, externally a longer posteriorly projecting lamina, and bearing in addition

a long curved prong, which surpasses the external lamina in length, and a much shorter prong, the apex of which overhangs the base of the long prong.

Loc. N.W. Borneo (*A. Everett*). Three male examples.

Hoplurorhachis Hosei, sp. n. (Fig. 13, p. 441.)

Resembling the preceding in colour, but easily recognizable by being more coarsely granular, having the pore closer to the side margin (barely three diameters from it on the twelfth segment), the anterior and posterior edges of the keels more coarsely serrulate, the process at the base of the posterior side more dentiform and less triangular, being narrower at the base; the tail broader, with the processes shorter, and the infero-lateral tubercle on the anal segment much longer; and, lastly, by the form of the copulatory feet, the ramus of this organ being distinctly curved when viewed from the side and terminating in two processes—an outer long curved prong, the apex of which is bent at right angles, and an inner branch, which is subdivided into a laminate portion and a two-pronged branch.

Length 69 millim., width 13.

Loc. Baram (Borneo). One example obtained by C. Hose.

Genus Phractodesmus, Cook.

Phractodesmus, Cook, Brandtia, i. p. 1 (1896).

Phractodesmus Ridleyi, sp. n.

♀.—*Colour* a uniform blackish brown, with a longitudinal white dorsal band (2–2·5 millim. broad) passing from behind the border of the first tergite to the posterior border of the nineteenth; legs and antennæ fuscous; sterna and bases of legs pale.

Antennæ longer than the width of the first segment, shorter than that of the second.

First tergite broadest along the anterior border, which is straight and transverse; the anterior angles not produced forwards, but continuous with the anterior border.

Dorsal surface of all the segments thickly granular, the rows of tubercles distinct even on the first tergite; keels depressed, their edges smooth, the anterior and lateral being slightly thickened, the latter lobulate, the former basally shouldered; the anterior angles bluntly rounded, forming an obtuse angle in the posterior half of the body, an acute one in the anterior half; the posterior angle not rounded, square or pointed, but not spiniform; porous area large, a diameter or

less from the edge. *Caudal process* with two pairs of prominent tubercles at the sides of the posterior border, which is rather strongly though not angularly produced mesially.

Sternal spines strong, the posterior pair directed posteriorly, the anterior pair downwards and forwards.

Measurements in millimetres.—Total length 76; width of second tergite 10, of fifth 12·5.

Loc. Singapore (*H. N. Ridley*).

In colouring this species seems to resemble *P. subvittatus*, Peters (Mon. Ak. Wiss. Berlin, 1864, p. 545), the type of the genus, which came from the island of Linga, 100 miles to the south-east of Singapore. There is nothing, in fact, in Peters's diagnosis to separate the two; but Mr. O. F. Cook, who has examined the type, says in his diagnosis of the genus *Phractodesmus*, "first segment broadest at or behind the middle," which is certainly not the case in *Ridleyi*; and again, "carinæ laterally margined outside the pore." But in *Ridleyi* the margination is scarcely, if at all, more noticeable than what is presented, for example, by *Acanthodesmus Andersonii*, Poc. So that, apart from geographical reasons, there is little doubt that the two are specifically different, though I strongly suspect they are referable to the same genus.

Genus Ilodesmus, Cook.

Ilodesmus, Cook, Brandtia, i. p. 1 (1896).

Ilodesmus Whiteheadi, sp. n. (Fig. 15.)

♀.—*Colour* black, with a longitudinal yellow band 3–4 millim. wide, extending from the summit of the head on to the caudal process; legs and antennæ fulvo-fuscous; sterna brown.

Antennæ a little longer than the width of the first tergite, much less than that of the second.

First tergite widest across the middle, its anterior border convex. Dorsum convex, rather coarsely but not very closely granular, nineteenth segment nearly if not quite smooth; the rows of tubercles traceable on all the segments except on the first, which seems to be uniformly granular. Anterior and posterior borders of the keels finely serrulate, lateral border not emarginate, but furnished with small rounded or sharp teeth, irregular both in shape and number; anterior border with basal shoulder; anterior angle squared even on the fifth segment, often a little produced laterally, the anterior border straight or slightly convex; posterior border slightly concave

even on the fifth segment; posterior angle acute, but hardly spiniform even at the end of the body. Pores separated by about their own diameter from the lateral border.

Caudal process broad, its border widely convex.

Sterna with very short tuberculiform processes at the bases of the legs.

Measurements in millimetres.—Total length 73; width of second segment 10, of fifth 12.

♂.—Smaller than female (length 55 millim., width of fifth segment 9·8), with larger keels. *Copulatory legs* with hairy portion of distal segment short, much shorter than distal portion, which is long, simple, and stout, with a strong curvature, its distal portion being directed upwards and outwards, ending in a slender filiform tip.

Loc. Albay, S.E. Luzon (*J. Whitehead*).

Perhaps identical with *dorsalis* of Peters from Luzon, which, according to Peters, is nearly allied to *margaritiferus*, Gerv. (=*Meyenii*, Brandt). This new form differs from *margaritiferus*, according to specimens in the British Museum, in being much more coarsely granular, with the posterior angles of the keels less acute. In spite of the fact that in this species the copulatory feet do not cross and are not branched, I believe it belongs to *Ilodesmus*.

Genus Taphodesmus, Cook.

Taphodesmus, Cook, Brandtia, i. p. 1 (1896).

Taphodesmus sanguineus, sp. n. (Figg. 14, 14 *a*.)

♀.—*Colour* black, the marginal thickening of the keels blood-red.

Antennæ a little exceeding width of first tergite in length, much less than width of second.

Dorsum of segments strongly convex; keels small, the three rows of tubercles conspicuous, subequal in size, the spaces between them and the upperside of the keels coarsely granular, the marginal thickenings of the keels irregularly tubercular; anterior angles of all the keels from the fourth backwards widely rounded, posterior angle squared or acute, not spiniform; anterior edge of keels basally shouldered.

Caudal process semicircularly rounded.

Sterna not spined.

♂.—Smaller than female and less convex. *Copulatory feet* closely applied along the inner edges of the distal segment, the terminal portion ending in three prongs, the proximal shorter, lightly curved, projecting outwards, the distal two

arising from a common stout branch, which curves strongly upwards and outwards.

Measurements in millimetres.— ♀. Total length 65; width of second segment 7, of fifth 8.

Loc. Minahassa, N. Celebes (*C. Hose*).

The generic position of this species is, I think, doubtful. The genitalia of the type are not known; but *T. sanguineus* at least differs from it in not having the pores borne in lateral excavations of the keels.

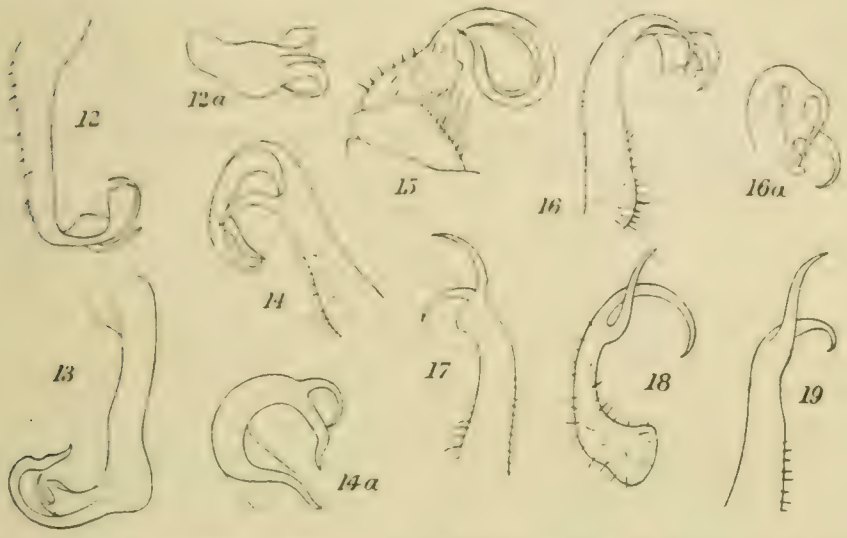


Fig. 12.—*Hoplurorhachis Everettii.* Right copulatory foot; outer view.
Fig. 12*a*.—Ditto. Apex of ditto from below.
Fig. 13.—*Hoplurorhachis Hosei.* Left copulatory foot; outer view.
Fig. 14.—*Taphodesmus sanguineus.* Right copulatory foot from below.
Fig. 14*a*.—Ditto. Apex of right copulatory foot.
Fig. 15.—*Ilodesmus Whiteheadi.* Left copulatory foot; outer view.
Fig. 16.—*Eutrachyrhachis margaritatus.* Right copulatory foot from below.
Fig. 16*a*.—Ditto. Apex of organ.
Fig. 17.—*Diodontodesmus Woodfordi.* Left copulatory foot from below.
Fig. 18.—*Diodontodesmus verrucosus.* Right ditto.
Fig. 19.—*Paradesmorhachis solomonis.* Ditto.

Eutrachyrhachis, gen. nov.

First tergite widest at or a little in front of the middle, its sides produced into angular processes.

Dorsal surface of body granular, the rows of tubercles very conspicuous, but not extending on to the keels, the posterior row coarser than the others. Keels not margined, laterally dentate. *Pores* close to the edge, scarcely dorsal; suture lightly sculptured.

Caudal process rounded, its tubercles prominent.

Anal sternite bitubercular.

Sterna granular, furnished with blunt tuberculiform processes at the bases of the legs.

Copulatory feet of male strongly curved inwards at the apex and ending in three processes.

Type *E. victoriæ*.

Eutrachyrhachis margaritatus, sp. n. (Figg. 16, 16 *a*.)

Colour black, the teeth on the keels and the tubercle on the dorsum clear and shining.

Antennæ not exceeding in length the width of the first tergite.

First tergite convex, depressed in the middle, swollen on each side, covered with granules, and bearing in addition four rows of large tubercles.

Keels of anterior segments depressed, those of the second larger than of the succeeding segments; upperside of all the keels coarsely granular, with two or three tubercles intermixed; anterior and posterior borders serrate or bluntly denticulate; lateral borders strongly and bluntly, but very variably toothed, bearing two, three, or sometimes four rounded teeth in addition to those at the angle; but sometimes there are but two, one close to each of the angular teeth, with a rather deeply emarginate space between; anterior angle of keels strongly shouldered.

Caudal process with border convex, the superior and marginal tubercles prominent.

Copulatory organ with its inferior (anterior) process forming a quadrate lamina; adjacent to this is a median, strongly recurved prong, while above and situated more proximally is another prong which curves beneath or above the last-named towards the lamina.

Measurements in millimetres.—Total length 43; width of second segment 6, of fifth 7.

Loc. Victoria Mountain, New Guinea.

Eutrachyrhachis victoriæ, sp. n.

♀.—*Colour* black, apices of keels yellowish red; the tubercles clearer yellowish.

Dorsal tubercles clearer than in *margaritatus*; margins of keels strongly bidentate, with usually one or more small tubercles between them; the anterior tooth much the largest on the second, third, and fourth segments, the posterior much the largest on the sixteenth, seventeeth, eighteenth, and nineteenth. Caudal process more ovate than in *margaritatus*,

the posterior border produced some distance behind the posterior lateral tubercles.

Measurements in millimetres.—Total length 55; width of second segment 7·5, of fifth 9.

Loc. Victoria Mountain, New Guinea.

In the form of its keels, as in other features, this species would seem to resemble *Platyrrhachis pergranulosus* of Silvestri (Ann. Mus. Genova, xxxiv. p. 639, 1895), from Maroka, in New Guinea; but the statement "segmentum primum angulis anticis rectis, valde productis" does not apply to the first tergite of *victoriæ*, in which the lateral angles have the form of a conical triangular tooth.

The structure of the copulatory feet of *Loriæ*, Silvestri (*loc. cit.*), and *pergranulosus* does not seem to be the same as that presented by *E. margaritatus*; *E. Loriæ* further differs in colour and *pergranulosus* in the form of its keels from *margaritatus*.

Diodontodesmus, gen. nov.

Allied to *Eutrachyrhachis*, but with the keels larger and higher, body less convex, the anterior cylindrical portion of the segments smooth; the area between the tubercles on the dorsum also smooth, and the suture not sculptured.

Copulatory foot of male ending in two simple branches directed inwards.

Type *D. Woodfordi*, sp. n.

Diodontodesmus Woodfordi, sp. n. (Fig. 17.)

♀.—*Colour* (of dry and probably faded specimen) a tolerably uniform greyish black; the cylindrical half of the segments white above, with a median dark stripe.

Length of *antennæ* less than width of first tergite.

First tergite granular, with only the posterior row of tubercles distinct, its anterior border evenly convex from the rounded angular lateral prominence; second and third segments also granular throughout, with large depressed keels. The rest of the segments very sparsely granular above, almost entirely smooth on the posterior end of the body, much more coarsely granular on the keels, the anterior lines of tubercles weak, the posterior conspicuous. Keels with anterior and posterior borders denticulate, anterior angle rounded, posterior angle acute but not spiniform; lateral margin lightly sinuate; keels of segments 2 to 13 directed obliquely forwards, keels not shouldered basally.

Pores dorsal, close to the border, rather less than a diameter from the edge.

Caudal process semicircular, with sinuate border.

Sterna nearly smooth, sparsely granular in front and behind.

Hairs on legs normal, setiform.

Measurements in millimetres.—Total length 62; width of second segment 8·3, of fifth 9·8.

♂.—Flatter and smoother than female, with keels larger and rather strongly bidentate, the lateral border from the fifth to the eighteenth being angularly emarginate, with sometimes minor denticulations.

Copulatory feet as in fig. 17, the anterior lower branch curving inwards, then abruptly downwards and backwards.

Measurements in millimetres.—Total length 55; width of second segment 8, of fifth 9.

Loc. Solomon Islands (*C. M. Woodford*).

Diodontodesmus verrucosus, sp. n. (Fig. 18, p. 441.)

♂.—Differing from the preceding species in being a uniform blackish tint throughout, in having the keels perfectly horizontal, the rows of tubercles much coarser, the two anterior rows extending right on to the keels and almost to the emargination, the three rows being very strong even on the first three segments; pores smaller and a little more lateral; caudal process with conspicuous lateral tubercles and a more transverse posterior border. Legs thinner, longer, and studded with clavate hairs.

Copulatory feet with a stout angular prominence at the base of the lower (posterior) prong; the prongs themselves longer than in *Woodfordi*.

Measurements in millimetres.—Total length 55; width of second segment 9, of fifth 9·6.

Loc. Solomon Islands (*C. M. Woodford*).

The species may be recognized as follows:—

a. Lateral margins of segments almost entire, at most sinuous (the rest as under a^1) ..... *Woodfordi*, ♀.

b. Lateral margins of segments strongly and angularly emarginate, so as to be bidentate (♂).

a^1. Anterior rows of tubercles on dorsum of segment very weak, obliterated on the anterior segments; cylindrical half of segments white above, with median black line ..... *Woodfordi*, ♂.

b^2. Two anterior rows of tubercles coarse and strong on all the segments, extending on to the keels; segments of a uniform tint ..... *verrucosus*, ♂.

PARADESMORHACHIS, gen. nov.

First tergite broadest behind the middle; keels of second and third tergites with simple toothed side-edges; fourth and following segments to the eighteenth with margins strongly thickened, smooth, as in many Oriental (*e.g.* Burmese) species of *Orthomorpha*, the pore situated on the thickening in its posterior half, about its own diameter from the edge, looking upwards and outwards; nineteenth tergite with simple normal keels; caudal process semielliptical; dorsal surface of segments granular, with three rows of tubercles or granules, the posterior being most conspicuous.

Sterna not spined.

Anal sternite bitubercular.

Copulatory foot of male with two long prongs, curved inwards apically.

Paradesmorhachis solomonis, sp. n. (Fig. 19.)

Colour a uniform greyish brown; margin of keels greenish grey, shining.

Length of *antennæ* nearly equal to width of second segment.

First, *second*, and *third tergites* somewhat coarsely granular all over, strongly convex, with the keels of second and third nearly horizontal, with toothed side margins, the anterior and posterior edges being much more finely toothed. The rest of the segments much smoother, the keels and back nearly horizontal, only weakly granular, the posterior row of tubercles conspicuous, the rest faint, the tubercles spreading on to the keels; anterior and posterior borders of keels irregularly tubercular, except on the thickened margin, which is smooth; posterior angles acutely rounded, in no sense spiniform; anterior angles obtusely rounded, anterior border strongly shouldered at base.

Copulatory feet strongly curved, the convexity outwards, ending in two long prongs, the lower angled at the base and running forwards, the upper continuing the curvature of the basal piece and projecting inwards and backwards.

Measurements in millimetres.—Total length 43; width of second tergite 5·8, of fifth 6·2.

Loc. Solomon Islands (*C. M. Woodford*).

POLYDESMORHACHIS, gen. nov.

First tergite broadest across the middle, where on each side it is furnished with a conspicuous tuberculiform keel. Second segment as wide as the fifth. Keels horizontal or elevated, keels of only the posterior three directed backwards.

Dorsum with three rows of tubercles, the posterior two rows very faint. *Keels* with lateral margins entire, though granular, those that bear the pore notched or emarginate posteriorly. *Pores* completely marginal, though just visible when the segment is viewed from above.

Caudal process semicircularly rounded.

Anal sternite bitubercular.

Sterna not spined.

Polydesmorhachis atratus, sp. n.

♀.—*Colour* of upper surface a uniform blackish brown, the edges of the keels only indistinctly yellow; legs and antennæ infuscate; sterna pale.

Antennæ short, their length a little less than width of second segment.

First tergite mesially depressed, elevated laterally and posteriorly, beset with tubercles and granules. Keels of segments 2 to 7 elevated, the rest horizontal; anterior and posterior borders of keels as far back as the seventeenth segment directed obliquely forwards, almost smooth, anterior border basally shouldered, anterior angle rounded and nearly rectangular, strongly convex on the sixteenth, seventeenth, and eighteenth segments; anterior border straight on the anterior part of the body, convex on the posterior seven keel-bearing segments; posterior angle never spiniform, obtusely rounded, square on the sixteenth, produced on the seventeenth to nineteenth. The dorsal surface of keels and of the rest of the segment granular, in addition to the tubercles; the suture of the segments costulate.

Measurements in millimetres.—Total length 61; width of second segment 8·5, of fifth 8·5.

Loc. Palawan Island, between Borneo and the Philippines (*A. Everett*).

LII.—*On two new Gammarids from New Zealand.*

By George M. Thomson, F.L.S.

[Plate X.]

The Amphipods described in the present paper were obtained in the Bay of Islands in January 1884. They were taken by me in the dredge in about 8 fathoms of water on a nearly clean sandy bottom. Only males were met with, and as, in the case of both species, they were very distinct and conspicuous on account of the abnormal development of the

second pair of gnathopods, I deferred publishing a description of them in the hope that I should find and recognize the female forms among the abundant material since obtained from many parts of the colony. This I have not yet succeeded in doing. It is, of course, perfectly possible that I have passed them over without recognizing them, having referred them to other species. The males are unmistakable. Of *Mæra Chiltoni* six specimens were taken, and of *M. Haswelli* four; but all are extremely fragile in structure and all are so much mutilated that in regard to certain limbs the structure has been but imperfectly made out.

*Mæra Chiltoni**, sp. n. (Pl. X. figs. 1–5.)

Body slender, rather compressed; pleon well developed.

Cephalon produced forward below the articulation of the superior antennæ into an obtusely pointed lobe on each side. The *eyes*, which are subreniform in shape, but broader in the lower than in the upper part, and are formed of numerous ocelli, occupy the greater portion of this lobe, and are placed close up to its anterior margin.

First antennæ.—First joint of peduncle stout, half as long as the cephalon, with a few setæ on the sides and at the extremity; second joint about twice as long, much more slender, and with six or seven tufts of setæ on the lower margin; third about two thirds as long as second, with a few tufts of setæ.

Flagellum lost; *secondary flagellum* (also lost) nearly as long as last joint of peduncle.

Second antennæ somewhat longer than cephalon and the three first thoracic segments; peduncle subequal in length with that of the first antennæ; first joint short, second and third subequal, nearly twice as long as the first, and with a few tufts of setæ on the lower margin; flagellum slightly longer than last joint of peduncle †.

Mandibles subquadrate; *left* with the cutting-plate produced almost at right angles to the basal portion into a stout two-lobed tooth, secondary plate shorter and two-toothed, spine-row reaching back almost to the molar tubercle, with about six curved spines; *right* (not satisfactorily made out) with secondary plate well developed, broadening upwards and ending in about four deep indentations; palp with the second

* Named in honour of Dr. Charles Chilton, F.L.S.

† Owing to an accident many of the smaller parts of the animal were lost after dissection; hence the imperfection of the description in several places.

joint elongated and flattened, broadening upwards, with scattered setæ along the margins, third joint shorter than second and broadened upwards, with a transverse crest of setæ on the dorsal surface and a fringe of setæ round the extremity and distal half of the lower margin, those at the apex of the joint very long.

First maxillæ with the inner plate in the form of an extremely short pointed lobe without any setæ; outer plate broad, nearly square at the extremity, ending in ten short spines and a few minute setæ; palp broad and flat, apparently three-jointed, the middle joint short, the extremity with a few short spines and setæ.

Second maxillæ with the outer plate slightly broader than the inner, setose at the extremity; the inner fringed with short setæ, chiefly round the inner margin.

Maxillipeds.—Inner plate reaching to the first joint of the palp, widening above and bearing on the extremities a few short broad spines, interspersed with short plumose setæ, which are continued a little way down the inner margins; outer plates about subequal with second joint of the palp, half as long again as the inner, broad and curved, furnished with numerous leaf-like spines and long simple setæ; palp four-jointed, the three last joints furnished with numerous setæ; last joint short and rounded, with one or two rather stout setæ at the extremity, but without a claw.

First gnathopods small; side-plates elongated, widening and rounded below, produced forwards at their infero-anterior angle; basos long and slender, front margin nearly straight, without setæ; ischium short; meros produced into an acute tip, sparingly setose; carpos well developed, subtriangular, broadest at the distal extremity, with several setæ along its sides and numerous tufts on its lower margin; propodos shorter than carpos, narrow-ovate, the oblique and dentate palm occupying about one third of the length, with numerous setæ on both margins; dactylos about two thirds as long as propodos, curved, very acute, and furnished with a few minute denticulations along its inner edge.

Second gnathopods very large, side-plates resembling those of the preceding pair; ischium and meros short, the latter produced forward like a tile, so that the carpos, which is attached almost at right angles to it, works in it as in a groove; carpos dilated distally, so as to have the form of an equilateral triangle; propodos large and subquadrate, its lower side straight and fringed with bunches of short setæ, its anterior side dilated into a large rounded protuberance, furnished with a bunch of setæ near the extremity and a few

scattered minute spines on its outer surface; the distal end of the joint is transverse; behind the articulation of the dactylos is an acute tooth, followed by a large rounded protuberance at the joint; palm furnished with one very large powerful conical tooth, followed by a deep indentation, while the postero-interior extremity of the palm is occupied by a square tooth, the top of which occupies more than a third of the length of the whole palm; dactylos strong, slightly curved, reaching a little beyond the end of the palm.

First and *second periopods* slender; *third* stout; *fourth* and *fifth* increasing in length posteriorly, rather slender and spinously setose.

Pleopoda well developed.

First uropods the longest; basal portion carrying five spines, which increase in length outwards, on the inner margin, and five or six very short ones on the outer; between the branches is a large acute spine; branches subequal, shorter than the basal portion, furnished with a few spines.

Second uropods with only two or three spines on each side of the base; inner branch about subequal with the base, somewhat longer than the outer, both spinose.

Third uropods shortest; branches subequal, slightly shorter than the base, spinose.

Telson subquadrate, the sides converging posteriorly, deeply cleft, each extremity bearing one spine-like seta.

Length 4–4·5 millim.; depth of body about one fifth of the length.

Hab. Taken with the dredge in about 8 fathoms in the Bay of Islands.

*Mœra Haswelli**, sp. n. (Pl. X. figs. 6–10.)

Body slender and compressed.

Cephalon produced at the sides into an acute angle between the bases of the first and second pairs of antennæ, not rostrate above.

Eyes with about eighty to ninety ocelli, produced well forward on the sides of the cephalon.

First antennæ with the first and second joints very short and almost merged into the front of the cephalon; third joint more than twice as long as broad, almost destitute of setæ. The three joints together are not more than two thirds as long as the cephalon; fourth joint slender, nearly twice as long as the third, with a few long setæ on the lower margin; fifth joint only about half as long as the fourth, also sparingly

* Named in honour of Prof. Haswell, F.R.S., of Sydney University.

setose. Flagellum broken off. Secondary flagellum four-jointed, about as long as the fifth joint of the peduncle.

Second antennæ with only one joint of the peduncle left, as long as and somewhat stouter than the third joint of the first pair, and bearing a few slender setæ, especially at the lower extremity.

Mandibles stout, with the basal portion subtriangular in form. *Right* with its molar tubercle in the form of a hollow crown, toothed all round the edge and with a few small setæ; cutting-edge, which with the tubercle is directed forwards, furnished with a row of five spines, very closely set, but not clearly made out; secondary plate strongly developed and ending in two large teeth. *Left* with two strong protuberances on the secondary plate. *Palp* slender, three-jointed; first joint very short, second and third subequal, the former with a row of about six or seven short setæ on the lower edge, the latter ending in a number of long setæ and with a tuft of two or three on its upper edge a little distance from the extremity. (The other organs were very small and fragile, and were unfortunately mutilated in dissection.)

First gnathopods small; carpos narrow-oblong, dilating outwards to the distal end, fringed on its lower margin with three or four bunches of setæ; propodos with three groups of dorsal setæ placed transversely and a tuft of setæ at the articulation of the dactylos, lower margin with setæ sparingly scattered along its edge; palm oblique and not well-defined; dactylos slightly more than half as long as the propodos, slender, slightly curved.

Second gnathopods abnormally developed, nearly half as long as the whole body; basos long and somewhat curved, especially on the posterior margin; ischium quadrilateral, as broad as and about one third as long as basos; meros small, triangular, with its lower side greatly produced into an acute lobe, bearing a few setæ near its extremity; carpos very much broader than long, also produced into a narrow triangular prolongation, which extends as far as that of the meros and bears one or two setæ; propodos about equalling in length all the rest of the limb, widening to the distal end, which is about half as broad as the length of the joint; dorsal surface smooth and curved, ventral straighter, ending in a strong tooth and with a few setæ near the extremity, distal end transverse, with a deep hollow inside the inner tooth, then having a small irregular tooth near the middle which bears a few setæ, and a slight protuberance at the hinge of the dactylos; the latter joint very long and falcate, with its inner edge nearly straight for the first half of its length, then sickle-shaped, its extremity reaching to the prolongations of

the meros and carpos, against which apparently it impinges and between which it is received.

Pereiopoda all wanting, except one of the fourth pair (which, on account of its brittleness, went to pieces during dissection), which was about one third as long as the body, and the joints of which were rather slender and were sparingly furnished with short almost spinose setæ.

Pleopoda slender.

First and *second uropods* reaching nearly to the extremity of the *third pair*. (Unfortunately, owing to the fragile state of the specimen, these appendages were broken up during dissection, so that details could not be satisfactorily settled.)

Telson apparently very short, cleft at the apex, and each side tipped with a very short spine (not well made out).

Length 4 millim.

Hab. Taken with the dredge in about 8 fathoms in the Bay of Islands.

EXPLANATION OF PLATE X.

Figs. 1–5. *Mæra Chiltoni.*

1. Animal, × 20.
2. Mandible, × 125.
3. Gnathopod of first pair, × 56.
4. Gnathopod of second pair, × 56.
5. Telson and last pair of uropods, × 56.

Figs. 6–10. *Mæra Haswelli.*

6. Animal, × 20.
7. Base of mandible, × 125.
8. Mandibular palp, × 125.
9. Gnathopod of second pair, × 41.
10. Telson, × 56.

LIII.—*A Revision of the Species of Butterflies belonging to the Genus* Teracolus, *Swains.* By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c.

[Continued from p. 399.]

25. *Teracolus Mananhari.*

Pieris Mananhari, Ward, Ent. Month. Mag. vi. p. 224 (1870); Afr. Lep. p. 2, pl. ii. figs. 1–4 (1873).

Anthocharis flavida, P. Mabille, Bull. Soc. Ent. Fr. (5) vii. p. xxxvii (1877).

Teracolus flavidus, P. Mabille, Grand. Madag. pl. xl. figs. 1, 1 *a*, 2, 2 *a* (1885).

Teracolus nothus, Mabille, *l. c.* p. 290 (1886)*.

Madagascar.

* M. Mabille quotes pl. xxxvi. *a*. fig. 2, but no such plate appears to have been published hitherto: at any rate, it is not in the Museum Atlas to the work.

Ward described the wet-season form (which is largest) with almost plain yellow under surface in the male, about two black spots in the primaries and an orange costal streak to the secondaries being the only markings on that surface; in the female the apical area of the primaries and the secondaries are buff on the under surface, the former with a subapical black bar representing the inner boundary of the black border of the upper surface and a discocellular black spot, the latter often with a slender interrupted angular discal stripe. *T. nothus* is represented by two intermediate forms, which occur in both sexes. The first has the under-surface pattern of *T. Mananhari* (typical), but the apex of the primaries and the secondaries are washed with rosy sienna; the second is slightly less reddish below, but has the addition of a longitudinal brown stripe through the centre of the secondaries; the female also has indications of striations on these wings. *T. flavida* is a smaller form in which the striation of the under surface appears in the male, but the angular band in that sex and the subapical band in the female are obsolete. Finally, there is a true dry-season form of which we possess the male only; it is small, the apex of primaries and the secondaries below fleshy buff, indistinctly striated, but without longitudinal streak or angular discal stripe.

26. *Teracolus incretus.*

♀. *Teracolus incretus*, Butler, Ent. Month. Mag. xviii. p. 146 (1881).
♂. *Callosune vulnerata*, Staudinger, Exot. Schmett. p. 46, pl. xxiii. (1884).

Ranges from the Victoria Nyanza southwards to Nyasa and eastwards to Mombasa and Bagomoyo.

Both types of the species are undoubtedly sexes of the wet-season form; the bad colouring of Staudinger's figure led Mr. Marshall to suppose that *T. vulnerata* was "clearly the dry-season form," but he is mistaken, for we have the latter. It is very rosy beneath, the male having the apical half and the secondaries, excepting towards apex, fleshy sienna, transversely striated with brown and more or less spotted; there is also frequently a longitudinal dusky streak from the base through the lower half of the discoidal cell in the secondaries.

27. *Teracolus auxo.*

Anthocharis auxo, Lucas, Rev. et Mag. de Zool. 1852, p. 422.
Anthopsyche topha, Wallengren, Lep. Rhop. Caffr. p. 15 (1857).
Anthocharis keiskamma, Trimen, Rhop. Afr. Austr. p. 56, pl. ii. figs. 3, 4 (1862–6).

The yellow form of this species appears to be strictly confined to Kaffraria and Natal, but a somewhat paler race occurs in Matabeleland. The extreme types *T. auxo* and *keiskamma* were proved by Mansel Weale and recently by Mr. Marshall to be wet- and dry-season forms of one species; *T. topha*, which is usually regarded as identical with *T. keiskamma*, appears to me to be an intergrade of which we possess six examples in the Museum.

Of the Matabele type, which only differs in its somewhat whiter coloration, we only possess males of the wet and intermediate forms.

28. *Teracolus dissociatus*, sp. n.

Allied to *T. auxo*, but with whitish or white ground-colour, tinted along edge of apical area with sulphur-yellow. The wet-season form differs also from that of *T. auxo* in that the male has a black oblique bar bounding the inner edge of the orange apical patch; the intermediate form * chiefly differs from *T. topha* in its white colouring and the much more limited apical orange patch; the dry-season form differs from *T. keiskamma* in its white colouring and much darker borders, but more especially in the females. In size this species agrees in all its forms with the more southern butterfly.

Ranges from Nyasaland northward by Kilima-njaro to the Victoria Nyanza.

29. *Teracolus evarne.*

Pontia evarne, Klug, Symb. Phys. pl. vi. figs. 1–4 (1829).
Pontia liagore, Klug, *l. c.* figs. 5–8 (1829).
Teracolus citreus, Butler, P. Z. S. 1876, p. 152.
Teracolus xanthevarne, Butler, *t. c.* p. 163.
Teracolus syrtinus, Butler, *t. c.* p. 163.

One of the most widely distributed and variable species of its group, ranging from Upper Egypt and the White Nile to Abyssinia, southwards to the Albert Nyanza, the Victoria Nyanza, and Kilima-njaro, and eastwards to Mombasa. On the western side it appears to be rare, but we have one example (the type of *T. syrtinus*) said to be from "Senegal" and a second recorded as simply from "West Africa." In ground-colour *T. evarne* varies from primrose-yellow to white, the typical form being almost white with yellow diffused bordering to the orange apical area; this is the wet-season form of the species and the most heavily marked with black. *T. xanthevarne* appears to be the prevalent form of the species in

* One of the supposed types of *T. syrtinus* referred to by Messrs. Trimen and Marshall.

Upper Egypt, the White Nile, and Abyssinia, and chiefly differs in its inferior size, yellower colouring, and frequently in the larger orange patch on the primaries. *T. syrtinus* is an intermediate-season form which apparently ranges westwards from Mombasa through the Sabaki valley, past Kilimanjaro and the Victoria Nyanza to Wadelai, and thence across the continent to Senegal, where it varies slightly from the normal form, the lower extremity of the orange apical patch being indistinctly bordered with blackish, so as vaguely to resemble the wet-season form of *T. auxo* (nobody, however, with an eye for species could calmly compare the two and for a moment regard them as identical). The males of this form never have the margin of the secondaries dotted, and on the under surface they show a slight tendency to rosy tinting. The females are altogether more lightly marked than those of typical *T. evarne*. *T. liagore* is probably little more than a rare starved albinism occurring in Egypt and on the borders of the Red Sea; in its weak markings it would seem to be a dry-season form, but the colouring of the under surface is that of the wet-season. I should look upon it as an intermediate form probably occurring just before the rains. *T. citreus* is the dry-season form occurring with typical *T. evarne*, but smaller, much more lightly marked above, and very rosy below.

30. *Teracolus Phillipsi.*

Teracolus Phillipsi, Butler, P. Z. S. 1885, p. 772, pl. xlvii. fig. 11.

Somaliland.

This is a well-defined local representative of *T. evarne* most nearly approaching the varietal form *T. liagore* in character. In all its seasonal phases it is much more lightly marked and paler in colouring than *T. evarne*, as well as slightly smaller than in the corresponding phases of *T. evarne*. The ground-colouring is always white, with the pale orange apical patch very faintly tinted with yellow along the inner edge; the marginal bordering even of the wet-season male is comparatively weak, while the secondaries are always unspotted. The female in the wet-season has the upper surface marked almost as in the dry-season female of *T. evarne*, while the intermediate type, which is much smaller, has the female still less marked above and striated below with greyish olive; the dry-season form is very small, the male without marginal markings, the female very faintly marked, but both sexes rosy and more or less striated below.

31. *Teracolus eucharis.*

Papilio eucharis, Fabricius, Syst. Ent. p. 472 (1775), but not Donovan.
Papilio aurora, Cramer, Pap. Exot. iv. pl. ccxcix. figs. A, B (1782).
Euchloe cæneos, Hübner, Verz. bek. Schmett. p. 91 (1816).
Pieris titea, Godart, Enc. Méth. ix. p. 124 (1819).
Teracolus pseudevanthe, Butler, P. Z. S. 1876, p. 164, pl. vii. fig. 16.
Teracolus pallens, Moore, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 49 (1877).

Ranges from Bombay southwards to Madras and Ceylon.

The seasonal forms of this species follow the usual rules, the wet-season forms being heavily marked above, yellowish and white with the usual markings below; the intermediate forms are similar above, but the females show more orange in the apical black patch; the dry-season forms are more lightly marked above and much more rosy and more strongly striated below. Of each form there are two phases, one showing a double bar on the under surface of the male secondaries, the other only showing a costal dash or dot. Of the double-barred type are, first, the wet-season form, which has received no distinctive name; then the intermediate form, representing *T. pseudevanthe*; lastly, the dry-season form, which is typical of *T. eucharis*. Of the costal marked type the wet-season form is again unnamed; the intermediate form is *T. aurora*; and the dry-season form *T. pallens*, which differs from all the other phases in showing no trace of the dusky spot on the inner edge of the orange apical patch in the male.

32. *Teracolus evanthe.*

Anthocharis evanthe, Boisduval, Sp. Gén. Lép. i. p. 567 (1836); Mabille in Grand. Mad. pl. xli. figs. 1, 2 (1887).
Anthocharis ena, Mabille, Bull. Soc. Philom. (7) iii. p. 134 (1879); Grand. Mad. pl. xl. figs. 6, 6 *a* (1887).

Madagascar.

This species appears to have no wet-season form. The variety *T. ena* is perhaps a little drier in character than the type, but both belong to dry-season phases.

33. *Teracolus evanthides.*

Callosune evanthides, Holland, Proc. U. S. Nat. Mus. vol. xviii. p. 268, pl. viii. fig. 9 (1895).

Aldabra, Comoro Islands.

Allied to *C. evanthe*, but evidently distinct. It has the brown irroration and striation of the under surface characteristic of the dry-season *T. evanthe* of Madagascar, but upon a pale yellow ground-tint, whereas in *T. evanthe* the ground-colouring of the under surface is dead white.

34. *Teracolus etrida.*

Anthocharis etrida, Boisduval, Sp. Gén. Lép. i. p. 576 (1836).
Teracolus pernotatus, Butler, P. Z. S. 1876, p. 159, pl. vii. fig. 1.
Teracolus farrinus, Butler, *t. c.* fig. 2.
Teracolus purus, Butler, *t. c.* p. 160, pl. vii. figs. 14, 15.
Teracolus casimirus, Butler, *t. c.* p. 161, pl. vii. fig. 5.
Teracolus bimbura, Butler, *t. c.* p. 161, pl. vii. figs. 3, 4.

Ranges from Persia to N.W. India, and thence through Bombay southwards to the foot of the Nilghiri Hills. I have seen no examples from the eastern side of India. I think that Mr. Marshall is incorrect in his assertion that it appears to range practically throughout India: our selected series of seventy-four specimens does not include one example from Eastern India. This makes it all the more probable that Mr. Marshall's inconsistent action in regarding the Ceylonese *T. limbatus* as a variety of *T. etrida*, whilst he regarded *T. danae* as quite distinct from the company to which he gave the name of *T. eupompe*, was an error. Just as *T. danae* differs from *T. dulcis*, so does *T. limbatus* differ from *T. etrida*, whilst the latter has the additional advantage of being a purely insular form.

Of the varieties of *T. etrida* to which I gave distinctive names, *T. farrinus* is the most heavily marked on the upper surface, though *T. pernotatus* runs it very close; *T. purus* is a dwarf form of the species with rather more orange at apex than in typical *T. etrida*. These are all wet-season or intermediate forms. The dry-season phase is represented by *T. casimirus* and the starved form of it which I described under the name of *T. bimbura*.

35. *Teracolus limbatus.*

Teracolus limbatus, Butler, P. Z. S. 1876, p. 161.

Ceylon.

The males of this species are always heavily bordered, and sometimes so much so that the marginal spots are perfectly confluent throughout; the species seems never to attain to the size of the largest examples of *T. etrida*. The female on the upper surface (like its male) resembles most nearly that sex of *T. etrida*, var. *farrinus*, but is more heavily bordered, shows scarcely a trace of the spot on the interno-median area of primaries, has brown instead of black markings on the under surface of these wings, and the discal markings on the secondaries very ill-defined. An example of this sex is in the Hewitson collection.

36. *Teracolus ephyia.*

Pontia ephyia, Klug, Symb. Phys. pl. vi. figs. 9, 10 (1829).

Occurs from Ambukol in Nubia northward to Upper Egypt.

The wet-season form of the male nearly resembles the male of typical *T. etrida* on the upper surface, but the female shows no trace of the interno-median spot of that species, whilst on the under surface all the discal spots are wanting. The dry-season form is smaller, shows scarcely a trace of the black inner edging to the orange subapical patch; the secondaries also have no marginal spots and the under surface is suffused with buff.

Mr. Marshall was quite correct as to the females formerly associated by me with this insect having nothing to do with it, but he should also have discovered how closely allied it is both to *T. etrida* and *T. lais*.

37. *Teracolus lais.*

Teracolus lais, Butler, P. Z. S. 1876, p. 145.
Teracolus halyattes, Butler, *t. c.* pl. vi. fig. 8, ♂.
Teracolus lycoris ♀, Butler, *t. c.* p. 140, pl. vi. fig. 6, ♀.

Ranges from Kimberley across the Orange Free State to Swaziland.

The female of *T. lais*, the wet- (not dry-) season form, bears a vague resemblance to that of *T. etrida*, var. *bimbura*, but the orange subapical bar has no inner blackish edging and there is no spot on the second median areole of primaries, the two marginal spots nearest to apex of secondaries are also confluent; on the under surface the basal area and apical border of primaries and the secondaries, with the exception of a discal patch towards apex, are washed with pale buff; the orange subapical curved bar of the primaries is paler than above, but the interno-median black spot is distinct. The males vary greatly in expanse, the type measuring about 34 millim., and a second example from the Godman and Salvin collection no less than 46. It approaches *T. ephyia*, but has more nearly the upper-surface pattern of *T. bimbura*, with pure white under surface (indistinctly irrorated with black scales when examined through a lens), the discocellular dots black, that of the secondaries attached to an orange spot; the costa of these wings is also narrowly orange towards the base.

My incorrect identification of the sexes of the dry-season form (*T. halyattes*) led Mr. Marshall into error. The male of the latter is much like the wet-season form above, but both

sexes below are alike, with grey-speckled rosy apical area to primaries and rosy secondaries, showing traces of an angular discal series of dusky spots, one or two of which are more or less prominent on the upper surface of the female; the apical patch in this sex is dark brown, with a curved subapical series of indistinct orange spots.

38. *Teracolus pallene.*

Anthocharis pallene, Hopffer, Peters's Reise, p. 358, pl. xxiii. figs. 7, 8 (1862).
Callosune pseudetrida, Westwood, in Oates's Matabeleland, p. 340 (1881).
Teracolus cinctus, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 105 (1883).

I believe that these are synonymous, although the description of the under surface of Westwood's type does not correspond in every detail with that of *T. cinctus*, and the female is described as having a subapical yellow fascia, whilst the female of *T. cinctus* has the apical area black, crossed by ill-defined narrow ochreous dashes. Still I believe that variation may account for these discrepancies. One thing is certain, Westwood's insect must belong to the *T. daira* group, and not to the singular mixed community in which Mr. Marshall has placed it, for it undoubtedly has the orange apical patch of the male black-bordered internally. Assuming that the above synonymy is correct, the species must be intermediate between *T. lais* and *T. infumatus*, and must range from the Victoria Nyanza southward to Nyasaland, and thence to Tete on the Zambesi. The intermediate form has the under surface washed with warm buff, and the dry-season form is small, with narrower black borders, the black internal streak ill-defined, and the secondaries rosy on the underside.

39. *Teracolus infumatus.*

Teracolus infumatus, Butler, P. Z. S. 1896, p. 128, pl. vi. figs. 5, 6.

Ranges from the Victoria Nyanza due south to Nyasa.

This species in its wet-season form is like a large and very heavily marked form of *T. pallene*, to which it is undoubtedly allied; but the intermediate-season form (of which we have a male from Lake Tanganyika) has the apical patch of orange more extended on the costa and not bordered internally by a black bar. This fact brings the species somewhat nearer to the *T. daira* group, in which the dry-season form has a similar character.

40. *Teracolus daira.*

Pontia daira, Klug, Symb. Phys. pl. viii. figs. 1–4 (1829).
Anthocharis nouna, Lucas, Expl. Alg., Zool. iii. p. 350, pl. i. fig. 2 (1849).
Anthopsyche demagore, Felder, Reise der Nov., Lep. p. 186 (1865).
Anthopsyche dalila, Felder, Reise der Nov., Lep. p. 188 (1865).
Teracolus xanthus ♀, Swinhoe, P. Z. S. 1884, p. 440, pl. xxxix. fig. 11.
Teracolus odysseus ♂, Swinhoe, *t. c.* p. 441, pl. xl. fig. 3.

Appears to range from Algeria to Egypt and thence southwards to Abyssinia and Somaliland.

The type of Felder's *T. dalila* is identical with the typical wet-season form, *T. odysseus* is an intermediate form, and *T. nouna* (of which *T. demagore* is a synonym) is the dry-season form. The latter, owing to its resemblance in the male sex to the dry-season forms of two other allied species, has been united to them and placed in the next group of species by Mr. Marshall, the whole being united under one heading as what he elegantly calls a "job lot."

41. *Teracolus stygia.*

♂. *Anthopsyche stygia*, Felder, Reise der Nov., Lep. p. 188 (1865).

Bogos, N.E. Africa.

This is an intermediate-season form, perhaps not distinct from *T. odysseus*, which it nearly resembles; it is, however, larger and differs slightly in some details of its pattern. The type, which I have examined, is in the collection of the Hon. Walter Rothschild.

42. *Teracolus Heuglini.*

Anthopsyche Heuglini, Felder, Wien. ent. Monatschr. iii. p. 272 (1859).
Teracolus Thruppi, Butler, P. Z. S. 1885, p. 770, pl. xlvii. fig. 10.
Teracolus Jamesi, Butler, *t. c.* p. 771.
Teracolus Jacksoni, E. M. Sharpe, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 336 (1890).

From Somaliland southwards to the Sabaki valley.

T. Jacksoni is the wet-season form, *T. Thruppi* the intermediate form, and *T. Heuglini* (=*D. Jamesi* ♂) the dry-season form.

43. *Teracolus evagore.*

Pontia evagore, Klug, Symb. Phys., Ins. pl. viii. figs. 5, 6 (1829).
Teracolus Yerburii, Swinhoe, P. Z. S. 1884, p. 441, pl. xxxix. fig. 12.
Teracolus saxeus, Swinhoe, *t. c.* pl. xl. figs. 1, 2.
Teracolus Swinhoei, Butler, *t. c.* p. 491.

Arabia.

T. Yerburii is the wet-season form, *T. Swinhoei* may be

taken as either a yellow variety or an intermediate type, and *T. evagore* (=*saxeus*) is the dry-season form. Practically the whole of the forms are dry-season, but they represent the seasonal phases which occur in more variable climates. That *T. evagore* is the dry-season phase of *T. Yerburii* (and consequently *T. Heuglini* of *T. Thruppi*, and *T. nouna* of *T. daira*) is evident from the fact recorded (P. Z. S. 1896, p. 247) that one pupa produced from a batch of larvæ bred by Capt. Nurse produced *T. evagore** and all the others *T. Yerburii*.

44. *Teracolus Emini*.

♂. *Teracolus Emini*, Butler, Ann. & Mag. Nat. Hist. ser. 6, vol. vii. p. 47 (1891).

Ranges from Abyssinia to the Albert Nyanza, thence southwards through Nyasaland to Delagoa Bay, whilst we have one male of the dry-season form from the Godman and Salvin collection which is said to have been obtained as far south as Graham's Town.

But for the fact that the dry-season form of this species exactly resembles that of the wet-season on the upper surface, I should not have hesitated to regard it as an exaggerated development of the closely allied *T. eione*. The latter, however, appears to be strictly confined to Southern Africa.

45. *Teracolus eione*.

Anthocharis eione, Boisduval, Sp. Gén. Lép. i. p. 578 (1836).
Teracolus galathinus, Butler, P. Z. S. 1876, p. 142.

Ranges from the Cape to Delagoa Bay.

The wet and intermediate forms of this species are much alike on the upper surface, the latter, however, with ochraceous apex to primaries and entire surface of secondaries below, whilst the dry-season form is much more lightly marked above, more rosy and irrorated with brown below; next to *T. Emini* it is the most heavily marked dry-season form of its group, and notwithstanding its general resemblance on the upper surface to the wet-season forms of *T. phlegetonia*, I do not consider that we have enough evidence to sink it with its widely differing wet phase as a mere variation of *T. phlegetonia*. When it can be *proved* (instead of *asserted* without proof) that *T. Emini*, *T. eione*, *T. antigone*, *T. xanthus*, *T. interruptus*, and *T. glycera* are only variations (uninfluenced by locality or climate) of one and the same species, I shall be one of the first to accept the position. At present I regard it as extremely improbable.

* He calls it *nouna*, but that is a mere trifling misidentification.

46. *Teracolus antigone.*

Anthocharis antigone, Boisduval, Sp. Gén. Lép. i. p. 572 (1836).
Anthocharis phlegetonia, Boisduval, *l. c.* p. 576 (1836).
Anthocharis delphine, Boisduval, *l. c.* p. 577 (1836).
Teracolus subfumosus, Butler, P. Z. S. 1876, p. 139, pl. vi. fig. 3.
Teracolus flaminia, Butler, *l. c.* p. 140, pl. vi. fig. 1.
Teracolus lycoris, Butler, *ibid.* (but not pl. vi. fig. 6).
Teracolus lyæus, Butler, *l. c.* p. 141, pl. vi. fig. 2.
Teracolus friga, Butler, *l. c.* p. 142, pl. vi. fig. 5.
Teracolus minans, Butler, Ent. Month. Mag. xviii. p. 229 (1882).
Teracolus coniger, Butler, *ibid.*

Ranges from Accra eastwards to the Albert Nyanza and thence southwards to Cape Colony.

When I described the above forms as distinct we had no examples of the very distinct wet-season phases from the south, nor was I aware of the variability or the seasonal distinctions which occur in *Teracolus*; therefore when I found half a dozen or more examples which seemed to correspond in the possession of certain characters in both sexes, I naturally supposed that I had different species before me. The Godman and Salvin collection, which was tolerably rich in examples of this species, has enriched our series, adding eight typical examples of *T. phlegetonia* (wet-season) from the Cape of Good Hope, also five examples of the variety *T. minans*=*coniger* from the Cape, as well as seven examples of the dry-season variety *T. delphine*. With our present series I am satisfied that the above synonyms represent one tolerably variable species. I cannot, however, believe that *T. antigone*, the wet-season form of which always has both the base and apex of the primaries bright lemon-yellow on the under surface, and which has a much narrower internal black stripe in all its forms, is identical with *T. eione* or *T. Emini*. Typical *T. antigone* has no internal stripe. Of the named forms, *T. phlegetonia* and *T. minans* are wet-season phases, *T. friga* is intermediate, and the remainder are variations of the dry-season form.

47. *Teracolus glycera.*

♂. *Teracolus glycera*, Butler, P. Z. S. 1876, p. 144.

Exact locality unknown. Type B. M.

It is possible that this may prove to be an aberrant intermediate-season form of *T. antigone*, for, although the inner margin of the orange apical patch is unbroken by the usual black marking, the primaries have the same yellow basal suffusion, and the other characters nearly correspond with those of that species.

48. *Teracolus xanthus.*

♂. *Teracolus xanthus*, Swinhoe, P. Z. S. 1884, p. 440, pl. xxxix. fig. 10.
Teracolus comptus, Butler, P. Z. S. 1888, p. 94.
Teracolus bifasciatus, E. M. Sharpe, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 336; ♀, Waterhouse, Aid, pl. clxxxix. (1890).

Ranges from Upper Egypt southwards to the Victoria Nyanza and Kilima-njaro, and thence to Nyasaland.

This is a northern and eastern development of *T. antigone*, usually smaller and more weakly marked on both surfaces, especially in the wet-season form. Only the more heavily marked examples of this form show any trace of the yellow basal suffusion on the under surface. At the same time it is possible that where the two forms meet they may interbreed, as is the case with some of the local races of birds.

49. *Teracolus metagone.*

Teracolus metagone, Holland, Proc. U.S. Nat. Mus. vol. xviii. p. 760 (1896).

East Africa.

This is a wet-season or intermediate form apparently nearly approaching *T. xanthus*, var. *bifasciatus* (=*comptus*); but without examining either a good figure or a typical example it would be rash to assert its identity with that species. It must, however, be borne in mind that the internal fascia on the primaries which occurs in the type specimens both of *T. bifasciatus* and *comptus* and the small transverse spot near the posterior extremity of the orange apical patch are not constant characters, but grade away to nothing even in our series.

50. *Teracolus interruptus.*

Teracolus interruptus, Butler, P. Z. S. 1871, p. 724; Lep. Exot. p. 115, pl. xliii. figs. 1, 2 (1872).
Teracolus lucullus, Butler, P. Z. S. 1876, p. 143, pl. vi. fig. 4.
Teracolus gelasinus, Butler, *t. c.* p. 143.

Appears to be confined to Angola and the neighbourhood of the Congo near its mouth. It is readily distinguished from the more northerly West-African type *T. antigone* by the absence of lemon-yellow at the base of the primaries below in any of its phases; the black internal bar is very faintly indicated in the wet-season form and wanting in the intermediate and dry forms.

51. *Teracolus agoye.*

Anthopsyche agoye, Wallengren, Lep. Rhop. Caffr. p. 15 (1857).
Anthocharis cosphorus, Trimen, Trans. Ent. Soc. ser. 3, vol. i. p. 523 (1863).
Teracolus Bowkeri, Trimen, *op. cit.* 1883, p. 358.
Teracolus zephyrus, Marshall, P. Z. S. 1897, p. 8.

South Africa.

I have carefully compared the various descriptions of this species with our examples, and have utterly failed to discover any reason for keeping them separate. Three examples from the Godman and Salvin collection of the wet-season phase obtained at Kimberley (two males and one female) agree remarkably well with Mr. Marshall's description: one worn and damaged male example in our series and one in the Hewitson collection of the intermediate phase, having the apex of primaries and the secondaries beneath creamy yellowish, are somewhat larger, with the black inner bordering of the apical patch continued almost to the first median branch; these are from Damaraland, and therefore should represent *T. agoye=cosphorus*; whilst a male in the Hewitson collection of the dry-season phase from the Transvaal has all the veins finely blackened above, the apical patch intermediate in size, with only its upper half black-bordered, its outer portion irrorated with greyish lavender, the apex of primaries and the secondaries below rose-pink. But for the comparative rarity of *T. agoye*, I am certain that Mr. Marshall would not have been so inconsistent as to regard the very slight characters upon which he has separated it into three species as either likely to be constant or of the least importance. There are hardly any of the forms which he has associated under his *T. evagore*, *T. evippe*, and *T. achine* which do not differ more markedly from one another. He himself says of specimens which he calls *T. achine*: "The undersides are equally variable, ranging from the type with black neuration to a specimen in which there is no trace of black"; and, under his *T. phlegyas*: "the development of the black on neuration is such an eminently unreliable character in this genus." It is perfectly well known also that the width of the black inner edging of the apical patch and the black costal streak on the secondaries are far less reliable, that the white or creamy under surface is dependent upon season, and that the discocellular dots are most inconstant. What characters then remain?

52. *Teracolus niveus.*

Teracolus niveus, Butler, P. Z. S. 1881, p. 177, pl. xviii. fig. 1.
Teracolus candidus, Butler, *t. c.* p. 178, pl. xviii. fig. 2.

Socotra.

T. niveus represents the wet-season phase and *T. candidus* that of the dry-season; the latter is less heavily marked than the type, and the orange patch, instead of filling the apex of the primaries, is represented by an oblique pale orange subapical band of five spots, widest in the middle and narrowest at its lowest extremity.

53. *Teracolus aldabrensis.*

Teracolus aldabrensis, Holland, Proc. U.S. Nat. Mus. vol. xviii. p. 269, pl. viii. figs. 7, 8 (1895).

Aldabra.

This is a very distinct and singularly coloured species. Without seeing the type, I should judge that its nearest relation was probably my *T. niveus*, from Socotra. It appears to be a wet-season form.

54. *Teracolus evenina.*

Anthopsyche evenina, Wallengren, Lep. Rhop. Caffr. p. 12 (1857).
Anthopsyche deidamia, Wallengren, Wien. ent. Monatschr. iv. p. 35 (1860).
Callosune deidamioides, Aurivillius, Kongl. Svensk. Vet.-Akad. Förh. 1879, p. 45.
Callosune inornata, Westwood, in Oates's Matabeleland, p. 338 (1881).

Southern Africa as far west as Damaraland, eastwards as far as the Zambesi.

The seasonal forms of this species differ but little on the upper surface; the dry-season male, however, has slightly less black on the inner margin and on the inner edge of the orange apical patch. *C. deidamioides* is the dry-season form.

55. *Teracolus casta.*

♂. *Callosune casta*, Gerstaecker, Arch. für Nat. 1871, i. p. 357; Van der Decken's Reisen in Ost-Africa, iv. 2, p. 365, pl. xv. figs. 1, 1 *a* (1873).
♂. *Teracolus sipylus*, Swinhoe, P. Z. S. 1884, p. 444, pl. xl. figs. 10, 11.
Teracolus callidia, Grose Smith, Ent. Month. Mag. xxiii. p. 32 (1886).

Ranges from Zanzibar south-westwards to Nyasaland and north-westwards to the Victoria Nyanza.

The seasonal variation of this species is considerably more marked than in the southern *T. evenina*; *T. sipylus*, the

extreme wet-season form, is usually distinctly larger than the wet-season form of *T. evenina*, and always has all the dark markings much heavier, the black marginal spots of the secondaries being connected by grey scaling into a continuous or partly confluent border and frequently preceded by a lunulated greyish submarginal stripe. Even Mr. Trimen, who states that the two species are inseparable, is constrained to admit that *T. sipylus* is "somewhat more heavily marked." *T. callidia* chiefly differs from the latter in having the secondaries below "brownish-white," and is probably an intermediate phase between the wet- and dry-season forms; the dry-season form is *T. casta*, which is far more lightly marked than any South-African example of *T. evenina*. It is true that in Gerstaecker's figure and in our single example the male has a white under surface; but this is often the case with individuals of the dry-season phase in other species of the genus, as, for instance, in those examples of *T. dedecora* (the dry-season form of *T. eupompe*) to which Felder gave the name of *T. theopompe*.

Did intergrades between *T. evenina* and *T. casta* exist, one would be bound to regard them as one species; but the supposed intergrades prove to be nothing of the kind when examined with a view to seasonal variation, and the two species remain as representative localized forms.

56. *Teracolus Carteri.*

Teracolus Carteri, Butler, Ent. Month. Mag. xviii. p. 227 (1882).
Teracolus laura, E. M. Sharpe, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 441 (1890).

Ranges along the West Coast of Africa from Senegambia to Accra, and thence across the continent eastwards to the Albert Nyanza.

Of this species I have only seen wet and intermediate phases. If a dry-season form occurs it should be looked for in Central Africa. Both types of the species belong to the wet-season form.

This may be regarded as a heavily marked development of the more widely distributed *T. isaura*, like which species it has the basal suffusion softly diffused, instead of almost uniform in tone with the blackish internal spot on the primaries. The wet-season form, however, is much larger than *T. isaura*, much more heavily bordered with black in both sexes, and with a black inner edging to the apical orange patch in the male. The intermediate form is as heavily bordered as the wet phase of *T. isaura*, whilst both wet and intermediate forms have the wings on the under surface

heavily black-veined below, a character extremely rare in *T. isaura*.

57. *Teracolus isaura*.

Anthocharis isaura, Lucas, Rev. et Mag. de Zool. p. 424 (1852).
Teracolus helle, Butler, P. Z. S. 1876, p. 149.

North Africa, from Upper Egypt to the White Nile and Abyssinia.

This species, regarded as a whole, is smaller and less heavily black-bordered than *T. Carteri*; the wet-season form has the veins below tipped with black, but it is most unusual even for the female to have them wholly blackened; the orange apical patch on the under surface of the primaries is much smaller and more diffused, and the orange markings on the secondaries are usually weaker. Both types belong to the wet-season phase, from which the intermediate form only differs in its more feeble black bordering, and on the underside in the less pronounced black tips to the veins; the dry form is still more weakly marked, without any black tips to the veins in the male, the female below being suffused with buffish salmon; it is possible that the male may sometimes have a rosy tinge below, but our examples do not show this dry-season character (which is not invariable).

58. *Teracolus antevippe*.

Anthocharis antevippe, Boisduval, Sp. Gén. Lép. i. p. 572 (1836).
Anthocharis zera, Lucas, Rev. et Mag. de Zool. p. 423 (1852).
Teracolus subvenosus, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 105 (1883).

Ranges from Senegal (where it appears to be rare) across the continent (to Abyssinia *, according to Lucas), southeastwards to the Albert Nyanza, the Victoria Nyanza, Kilimanjaro, and thence still eastwards to Zanzibar.

Although related to *T. isaura*, this species appears to me to hold its own; it is much more variable than *T. isaura*, frequently showing a black internal stripe on the upper surface of the primaries and an imperfect black inner edging to the orange apical patch: the female in all its phases is much more heavily marked with blackish basal clouding and still blacker internal stripe on the primaries; the borders and subapical bar are also blacker than is usual in *T. isaura*, and the angular band on the secondaries more strongly defined; the veins on the under surface of the wings are either black

* I believe, however, that Lucas confounded with it the males of *T. helle* (the dry-season form of *T. isaura*).

externally (*T. subvenosus*), but never connected with a black marginal line as in *T. isaura*, or are merely dusky towards the tips (*T. antevippe*): the dry-season form (*T. zera*) has the under surface suffused with creamy pink, and is the least heavily marked type on the upper surface.

Strictly speaking, the males of this species, without any trace of the blackish internal stripe on the upper surface (typical *T. antevippe*), should perhaps be regarded as an intermediate phase between the wet- and dry-season forms, the wet form being represented by *T. subvenosus*.

59. *Teracolus ithonus.*

Teracolus halyattes ♀, Butler, P. Z. S. 1876, p. 145, pl. vi. fig. 8 (part.).
Teracolus ithonus, Butler, *t. c.* p. 146, pl. vi. fig. 7.
Teracolus harmonides, Butler, *t. c.* p. 146.
Teracolus hippocrene, Butler, *t. c.* p. 147.
Teracolus ignifer, Butler, *ibid.*
Teracolus hyperides, Butler, *t. c.* p. 149.
Teracolus hero ♂, Butler, *t. c.* p. 150, pl. vi. fig. 12 (part.).
Callosune damarensis, Aurivillius, Efv. Ak. Förh. xxxvi. 7, p. 46 (1879).
Callosune Haevernickii, Staudinger, Exot. Schmett. p. 45, pl. xxiii. (1884).

Ranges from Kaffraria to Swaziland.

This may be regarded as the Southern representative of *T. antevippe*. It is much less heavily marked with black above, and, excepting in the male of the wet-season form (*T. hero* ♂), is more or less densely irrorated with brown scales on the under surface; even in this form the internal streak of the primaries and costal streak of the secondaries are incomplete. Two forms of all the phases occur, those of the wet and intermediate phases chiefly differing in size, having the under surface of the secondaries white, densely irrorated with brown; those of the dry-season form, however, are less alike; the larger form (*T. ignifer*=*damarensis*) has the under surface of the secondaries and apex of primaries rose-pink, finely irrorated with greyish brown in the males, somewhat more sandy in colouring, with the usual transverse banding in the females, the smaller form (*T. ithonus*=*harmonides*=*Haevernickii*) differing from the latter in the deeper more sandy colouring of the under surface, with coarse transverse striation rather than irroration. The forms may be summarized as follows:—

Wet-season.	Intermediate.	Dry.
T. hero (large).	Unnamed (large).	*T. ignifer* (large).
T. hippocrene.	*T. hyperides* ♀ (small).	*T. ithonus* (small).
Syn. *hyperides* ♂ (small).		*T. harmonides* (starved).

The female wrongly referred to *T. halyattes* is referable to typical *T. ithonus* (the smaller dry-season form).

60. *Teracolus achine.*

Papilio achine, Cramer, Pap. Exot. iv. pl. cccxxxviii. E, F (1782).
Teracolus simplex, Butler, P. Z. S. 1876, p. 148.

Ranges from the Cape to Natal, the Transvaal, and apparently northward as far as Nyasaland.

The wet and intermediate forms of this species have a well-defined internal stripe on the upper surface of the primaries; the apical patch in all the phases is bright vermilion, with a crimson tinge, but on the under surface the subapical orange bar is weak and diffused; in the intermediate and dry-season forms the under surface of the secondaries is irrorated and striated with grey upon a pale pink ground; the dry-season form (*T. simplex*) differs in having no internal blackish stripe on the primaries and no costal stripe on the secondaries of the male, and in the feebleness of all the other blackish markings on the upper surface.

Subspecies *Teracolus Trimeni.*

Teracolus Trimeni, Butler, P. Z. S. 1876, p. 150.
Callosune ramaquebana, Westwood, in Oates's Matabeleland, p. 341, pl. E. figs. 5, 6 (1881).
Teracolus fumidus, Swinhoe, P. Z. S. 1884, p. 442, pl. xl. figs. 4, 5.

A representative form of *T. achine* apparently confined to the Eastern side of Africa from the Transvaal northward as far as Manboia. The typical (wet-season) form is generally more heavily marked above with black than in *T. achine*, the male even sometimes showing traces of the angular black band on the secondaries characteristic of the female; on the under surface also, which is more creamy in tint than in *T. achine*, this angular band is sometimes indicated in saffron-yellow. *T. fumidus* (of which *T. ramaquebana* is the female) is merely a starved form of the subspecies. The dry-season form is less strongly marked than in that phase of *T. achine*, and is characterized by the usual rosy coloration on the under surface. Of our eighteen examples of this subspecies no less than sixteen were obtained in the Transvaal, nine of which were received in the Godman and Salvin collection.

T. ramaquebana, curiously enough, is referred by Mr. Guy A. K. Marshall to the synonymy of his heterogeneous "*T. evagore*," one of the most singular combinations of dry- and wet-season forms, of species belonging to widely different sections of the genus, which have been associated together

since the days of Hewitson! It only shows how utterly impossible it is to write a correct synonymic paper upon any genus without first arranging the species, having due regard at the same time not only to seasonal variation, but to geographical distribution. Never since I first arranged the genus was it in such a perplexing state of chaos as during Mr. Marshall's few visits to it with a view to "clearing up" the synonymy. The natural result is that the "clearing up" has resulted in partial failure.

61. *Teracolus gavisa.*

Anthopsyche gavisa, Wallengren, Lep. Rhop. Caffr. p. 13 (1857).
Teracolus hero ♀, Butler, P. Z. S. 1876, p. 150, pl. vi. fig. 12 (part.).
Teracolus subvenosus ♀, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 105 (1883).

Ranges from Natal to the Victoria Nyanza along the eastern littoral.

This species differs from *T. achine* in its much bolder marking in all its seasonal phases, the reduction of the crimson apical patch on the primaries of the males, and the well-defined black veining on the under surface of the wet-season form. "*T. subvenosus* ♀" is a typical female of *T. gavisa*, but "*T. hero* ♀" a singularly heavily marked and buff-tinted female of the intermediate phase.

I should regard *T. gavisa* as at least subspecifically distinct from *T. achine*, at any rate until it has been proved by breeding to be a mere varietal development of that species. It can always be easily distinguished in all its phases.

62. *Teracolus omphale.*

Pieris omphale, Godart, Enc. Méth. ix. p. 122 (1819).
Anthocharis theogone, Boisduval, Spec. Gén. Lép. i. p. 575 (1836).
Anthopsyche procne, Wallengren, Lep. Rhop. Caffr. p. 323 (1857).
Teracolus omphaloides, Butler, P. Z. S. 1876, p. 151.
Teracolus corda, Möschler, Verh. zool.-bot. Ges. Wien, xxxiii. p. 278 (1884).
Teracolus complexivus, Butler, P. Z. S. 1885, p. 770.

Ranges along the eastern side of Africa from Somaliland to the Cape.

T. omphale is a very variable species, the most heavily marked of the wet-season forms occurring in Nyasaland, where the marginal spots on the upper surface of the secondaries frequently unite into a broad continuous border; the discal black belt on these wings in the male varies enormously, sometimes broad from abdominal margin to outer border, sometimes slender, sometimes barely indicated. In the inter-

mediate phase (*T. omphaloides=complexivus*), which has a dry-season under surface, the discal black belt is either barely indicated or wholly absent. *T. corda* is merely a starved variety of the male of this phase. *T. theogone=procne* is the extreme dry-season form, in which the black discal belt of the male has wholly disappeared and the internal stripe on the primaries nearly so, whilst the female is much less heavily marked than in the wet-season, and is sometimes yellow, flushed with orange above; the under surface of the dry-season form is very rosy and irrorated with clay-brown.

63. *Teracolus exole.*

Anthocharis exole ♂, Reiche, Ferr. & Gal. Voy. Abyss. pl. xxxi. fig. 4 (1849).
Anthocharis eurygone (?), Lucas, Rev. et Mag. de Zool. 1852, p. 341.
Anthopsyche acte, Felder, Reise der Nov., Lép. p. 187 (1865).
Anthopsyche roxane, Felder, *l. c.*
Teracolus hybridus, Butler, P. Z. S. 1876, p. 152.

Ranges down the east coast from the Sabaki valley to the Cape.

It is perhaps only an emphasized form of *T. omphale*, from which it chiefly differs in the greater development of black on the upper surface, even the dry-season phase having a distinctly wet-season pattern above. The female figured by Reiche as that sex of *T. exole* is *T. antevippe*. *T. acte* of Felder is the true female (wet-season form), *T. roxane* is a female of the intermediate phase, and *T. hybridus*, which Mr. Marshall places as an intermediate phase of *T. evippe*, is the dry-season form. *A. eurygone* answers best to the wet-season form of *T. exole*, but the locality "Coast of Guinea" is rather against this identification.

64. *Teracolus pyrrhopterus.*

Teracolus pyrrhopterus, Butler, P. Z. S. 1894, p. 575, pl. xxxvi. figs. 8, 9.

Apparently confined to the vicinity of Mount Kenya: two specimens (the types) not being ticketed with exact locality, I supposed them to be from the Sabaki valley; the same was the case with three examples of the wet-season form, but others are labelled Thegu and Thagana. Guaso Thegu is a gorge to the west of Mount Kenya, and Thagana appears not to be far off.

The wet-season form of this butterfly resembles small and lightly marked examples of *T. omphale* on the upper surface, but below it inclines to pink rather than cream-colour in tint, and this is especially the case with the discal stripe on the

secondaries, whilst the subapical patch on the primaries is bright brick-red, as in the brightest examples of *T. theogone* (the dry-season form of *T. omphale*). The intermediate phase has the black banding of the upper surface still weaker, and below the subapical patch on the primaries and the discal stripe across the secondaries are sharply defined and very vivid upon a creamy ground-tint; the fringes rosy: the (typical) dry-season form retains the black internal stripe on the primaries, which is absent in males of *T. theogone*, and still shows a trace of the discal stripe on the secondaries; the apex of primaries and the secondaries below are bright rosy, the former with diffused bright brick-red subapical patch, the latter with the discal stripe varying from brick-red to gravel-brown.

I cannot agree at all to Mr. Marshall's arbitrary decision that this localized form is inseparable from *T. omphale*, no examples of which that I have ever seen in the slightest degree resemble its dry-season phase. That *T. pyrrhopterus* and *T. omphale* had a common origin will not be disputed, but that they are now distinct I firmly believe.

65. *Teracolus evippe.*

Papilio evippe, Linnæus, Mus. Lud. Ulr. p. 239 (1764).
Papilio arethusa, Drury, Ill. Exot. Ent. ii. pl. xix. figs. 5, 6 (1773).
Papilio eboea, Cramer, Pap. Exot. iv. pl. ccclxii. figs. C, D (1782).
Papilio hanna, Herbst, Natursyst. Schmett. pl. cvii. figs. 5, 6 (1792).
Pieris amytis, Godart, Enc. Méth. ix. p. 123 (1819).
Anthocharis cebrene, Boisduval, Sp. Gén. Lép. i. p. 583 (1836).
Teracolus pseudocale, Butler, P. Z. S. 1876, p. 154, pl. vi. fig. 9.

On the west of Africa this species ranges from Sierra Leone to Old Calabar and the Cameroon Mountains; it reappears at the Cape, and extends up the east side of Africa as far as Natal. We have one almost typical example from the West Coast as far south as Loanda; therefore, although the species is represented in S.W. Africa by *T. ocale*, the latter can hardly be regarded as more than a climatic race. On the other hand, the northern *T. epigone* appears to be geographically separated from *T. evippe*, and, though nearly allied, must be regarded as a distinct species. *T. pseudocale* is a starved southern variety of the wet-season phase.

The females of the typical wet-season *T. evippe* vary considerably in ground-tint and in the character of the apical patch; the rarest form of the female is that which most nearly approaches the south-western race, with white ground-tint and the black apical patch of the primaries enclosing a clear orange arched band; a second less rare form has this band

much reduced and less clear; then comes the *arethusa* of Drury (which has received the names of *eborea* (part.), *hanna*, *amytis*, and *cebrene*), in which the orange has almost disappeared from the apical patch; the remaining varieties agree with the latter in character, but are sulphur-yellow or bright ochre-yellow in ground-colour.

Race *Teracolus ocale.*

Anthocharis ocale, Boisduval, Sp. Gén. Lép. i. p. 584 (1836).
Teracolus loandicus, Butler, P. Z. S. 1871, p. 724; Lep. Exot. p. 91, pl. xxxiv. fig. 10 (1872).
Teracolus suffusus, Butler, P. Z. S. 1876, p. 152, pl. vi. fig. 10.
Teracolus angolensis, Butler, P. Z. S. 1876, p. 154.

Occurs along the S.W. coast in the neighbourhood of Angola, and possibly further south.

The wet-season form of this race most nearly resembles *T. evippe*, var. *pseudocale*, but the female seems always to have the apical patch divided by a clear and often broad orange belt. *T. suffusus* was based upon an unusually dark and dwarfed example of the female. Wet, intermediate, and dry phases are all much alike on the upper surface, the dry form alone having much less black on the inner edge of the orange apical patch, giving it a totally different aspect from the southern dry phase of typical *T. evippe*, which has a fairly well-marked continuous black inner edging to the apical patch of the male; it is, however, possible that intergrades may occur between the two extremes. There appears to be no dry phase to *T. evippe* at or near Sierra Leone.

66. *Teracolus epigone.*

Anthopsyche epigone, Felder, Reise der Nov., Lep. p. 186 (1865).
Teracolus microcale, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 487 (1876).

Ranges from Upper Egypt to the White Nile and Abyssinia, and occurs also near Aden.

This species nearly resembles the Angolan *T. ocale* in all its phases, but the male always has a well-defined black inner border to the orange apical patch on the primaries, whereas the female is less prominently marked above with black than in any form of *T. evippe*, the spot which terminates the internal blackish streak on the primaries being wholly absent, and even the basal blackish irroration being either much restricted or wanting. At the same time, if it could be shown that *T. evippe* extended across Africa northwards from the West Coast, I should be inclined to regard *T. epigone* as a mere climatic race; but there seems to be no evidence what-

ever upon which to base such a decision, and therefore, in spite of its affinity to the Angolan race of *T. evippe*, I am constrained to consider it a distinct species.

The argument on which Mr. Marshall bases his synonymy of *T. evippe* and *T. omphale*, which he regards as one variable species, is based upon the confusion which existed previous to its rearrangement in the drawers of those species in the Museum collection—a confusion largely due to the incorporation of accessions since the date of the first arrangement of the genus about the year 1876 or 1877. He says that in Eastern Africa *T. evippe* is "an intermediate seasonal form of *theogone-omphale*"; but this is certainly not the case, for *T. evippe* is essentially, in all its characters, a wet-season phase; nor does it appear to extend in the East further north than Natal.

[To be continued.]

LIV.—*Phenomena of Autotomy observed in the Nymphs of* Monandroptera inuncans, *Serv.*, *and* Rhaphiderus scabrosus, *Serv.* By Edmond Bordage *.

In the month of September last year I succeeded in obtaining larvæ and nymphs of *Monandroptera inuncans* and *Rhaphiderus scabrosus*, in which I studied the phenomena of autotomy, in order to compare them with those that I had observed in the case of the adult insects.

These phenomena were exhibited very clearly by the very young larvæ. On pinching hard the distal extremity of the femur, I generally produced the separation of the limb. The interval that elapses between the stimulation of the nerve and the rupture of the limb varies from a few tenths of a second to three or four seconds. The same operation could be attempted successfully upon all six limbs.

In the case of the older larvæ and nymphs autotomy is sometimes produced still more easily; but it may happen that it becomes irregular and capricious—a feature that we have already pointed out in the adult Phasmids. We must also make mention of the increase in the time between the stimulus and the rupture. Although this increase is not manifested in an absolutely universal manner, it is of very

* From the 'Comptes Rendus, t. cxxiv. no. 4 (Jan. 25, 1897), pp. 210–212: from a separate impression communicated by the Author.

frequent occurrence and may be expressed by a certain number of minutes.

It has happened that I have pinched, till I crushed them between the finger-nails, several limbs of a nymph, without succeeding in producing autotomy.

Quite tired out, I placed the insect upon a table: it moved along with difficulty, dragging its legs, which had been rendered useless; then, after four or five minutes (a quarter of an hour sometimes), the injured appendages broke off cleanly, not at the points where they were crushed, but always at the spot at which rupture by autotomy normally takes place. Only in a few cases have I seen the crushed limb not separate itself from the thorax. Judging by their lack of vigour and by a certain flaccidity of body, I am led to believe that I was then dealing with nymphs on the point of performing an ecdysis. Moreover, the experiments attempted upon them were followed shortly by the death of these insects.

The influence of thermic agents seldom gave me good results. A limb which I placed in contact with a lighted match sometimes detached itself after a few seconds; in other cases it allowed itself to be charred until reduced to a mere stump without becoming detached from the thorax.

The rapid section of the femur, at whatever point it be performed, does not always produce autotomy (nevertheless this process infallibly occasions the rupture of the great limbs of the grasshopper). Sometimes, after having thus amputated part of the limb in vain, I placed a lighted match in contact with the wound, and it was only in certain cases that this produced the spontaneous severance of the stump.

Since the effect of the bites of ants is identical with what we observed in the case of the adult insects, we will not revert to this point. We may mention, however, that we have never seen the ants succeed in producing the autotomy of all six limbs.

As we have already stated, the phenomena of autotomy are not exhibited in a regular manner in the Phasmidæ, at least in the species that we have studied. In spite of this our experiments, performed upon a large number of specimens of *Monandroptera* and *Rhaphiderus*, have enabled us to establish the fact that in the nymphs autotomy becomes increasingly difficult in proportion as these nymphs draw nearer to the final metamorphosis.

Since the month of September 1896 I have kept in captivity nymphs of *Rhaphiderus* and *Monandroptera*, a thing somewhat difficult to do, since these insects normally live at an altitude of upwards of 700 or 800 metres. They browse

on the leaves of the guava (*Psidium*) and the cassowary-tree (*Casuarina*), as well as on the foliage of *Agauria pyrifolia* *.

After having produced in the case of a few specimens amputation by autotomy, I have succeeded in observing the regeneration of the amputated limbs. A regenerated appendage is always distinguished from the corresponding limb of the same pair by its smaller dimensions and a slightly different coloration.

The difference in dimensions clearly attains its maximum when the victims of amputation are nymphs having to undergo but few moults before reaching the fully developed state. A very interesting point is that in a regenerated limb the tarsus always † has only four joints instead of five.

This fact undoubtedly affords the explanation of the following mistake on the part of Westwood:—

The entomologist in question, having been placed in possession of a specimen of *Monandroptera* (*Diapherodes*) *undulata*, wrote in the description that he gave of it:—"This fine insect is remarkable for having only four joints in the anterior tarsi, differing in this respect from all the known species of the family to which it belongs" ('Arcana Entomologica,' vol. i. p. 26). It is evident that Westwood was dealing with a specimen which, when a nymph, had lost by autotomy its two front limbs.

This is further proved by the following words:—"The anterior limbs are also relatively much shorter than the rest."

Neither did Ch. Coquerel, who had nevertheless studied the Phasmidæ of Bourbon, in this very island even, recognize the true cause of this curious fact. Criticizing the opinion of Westwood, he wrote:—"It was probably a case of structural imperfection peculiar to this individual, or perhaps Westwood had to deal with an insect which had been damaged and mended by an incompetent hand" (Ann. Soc. Entom. de France, 1861, p. 495).

In a subsequent paper I propose to study the process of regeneration of the limbs in the nymphs of Phasmidæ, as well as a number of anatomical peculiarities in these Orthoptera.

* *Agauria pyrifolia* is a shrub belonging to the family Ericaceæ. Its highly poisonous leaves have often been the cause of cases of poisoning among cattle. They do not produce any effect, however, upon the Phasmids under discussion, which eat them with avidity.

† [The word in the original is "souvent" (frequently); in the separate impression before me, however, the author has altered this into "toujours" (always).—Transl.]

LV.—*Phenomena of Autotomy in* Phasmidæ *belonging to the Genera* Monandroptera *and* Rhaphiderus. By Edmond Bordage *.

The islands of Réunion and Mauritius possess two splendid Phasmidæ belonging to the genera *Monandroptera* and *Rhaphiderus*—*M. inuncans*, Serville, and *R. scabrosus*, Serv. (*Monandroptera spinigera*, Lucas).

In the case of the former species the female is apterous and attains a length of 20 centim. by 25 millim. in breadth; its colour is brown or grass-green. The male, which is greenish grey or green and less clumsy in shape, does not exceed 17 centim. in length by 18 millim. in breadth; it possesses very rudimentary elytra, of the colour of the body, and fairly long wings tinged with pale rose and brown, and having an opaque green margin.

The dimensions of the specimens of *Rhaphiderus scabrosus* are considerably less; the female, which is brown or a magnificent grass-green, attains a maximum size of 8·5 centim. in length by 11 millim. in breadth and is devoid of wings. The male, which is likewise apterous, assumes a brown hue and resembles a little twig. It is but 6·5 centim. in length and does not exceed 5 millim. in breadth.

A few months ago, having succeeded in obtaining a few of these curious Orthoptera, I inadvertently left a *Monandroptera* upon a laboratory table. A moment or two later the insect, which was lying upon its back, had lost its two front legs, and I found to my astonishment that I was confronted with phenomena of autotomy, brought about by two specimens of *Plagiolepis longipes*, Forel. (This is an ant which belongs to India, and was introduced a few years ago by means of ships into Mauritius and Bourbon, where it has invaded the dwellings on the coast.) The severance was produced between the femur and the trochanter †; the cut was as clean as

* From the 'Comptes Rendus,' t. cxxiv. no. 7 (Feb. 15, 1897), pp. 378–381: from a separate impression communicated by the Author.

* The trochanter and femur, instead of being united by an articulation allowing of their movement one on the other, are, on the contrary, fused together. It was only after I had discovered the phenomena of autotomy that I noticed this fusion, which is, however, indicated by a little groove. After autotomy the portion that still remains attached to the body comprises the coxa, united by the arthrodial membrane to a little ring or cushion, which is nothing but the trochanter separated from the femur by the neatest of circular fractures. This fusion, therefore, of the trochanter and thigh, or femur, strongly reminds us of that which we observe in the crabs between the basipodite and ischiopodite.

possible, and the loss of blood had been insignificant. The ants succeeded once more in separating a third limb under my very eyes, and there the process stopped. I repeated the experiment, and always with success; but in one solitary case, in which the victim was a female *Monandroptera*, I was able to remark the rupture of the whole of the limbs. The anterior legs, where the base of the femur is greatly attenuated, are usually those in which the ants most easily succeed in producing autotomy.

The ants do not work by pulling, but, in truth, by bites inflicted upon the interarticular membrane, between the coxa and the trochanter, or between the femur and the tibia. The action of a single ant is sometimes sufficient. In certain cases autotomy takes place immediately, in others a certain time elapses between the infliction of the bite and the moment when amputation ensues. Thus, after having observed the presence of ants upon the limbs of a Phasmid, it has happened that I have picked up the insect, carefully avoiding seizing it by the legs, in order to remove it from the action of its aggressors. Under these conditions I have sometimes seen autotomy take place four or five minutes after the bite. It also occurred sometimes when I lifted the insect gently, without shaking or squeezing it, by one of the legs upon which I had observed the ants inflicting their bites a few moments before. Without the least muscular contraction the insect abandoned its leg and fell.

Formic acid therefore has a very powerful action, readily provoking autotomy.

With few exceptions it was only with real difficulty that I was able to bring about autotomy in adult specimens of *Rhaphiderus* and *Monandroptera*—a result produced by the ants with ease, in the case of two or three limbs at any rate.

The exceptions were provided chiefly by *Rhaphiderus*. In certain cases, on holding the insect suspended by a limb and exerting, by means of the finger-nails, strong pressure upon the median region of the femur, I have succeeded in producing autotomy; the phenomenon was reproduced in the same manner in the case of the five other legs. I have succeeded in arriving at the same result by inflicting burns or cuts towards the distal region of the femur.

I met with more difficulty in the case of the *Monandroptera*. It was the utmost I could do if, in a few specimens, I succeeded in causing the detachment of two or three limbs.

Very often I found it impossible to produce a single case of autotomy in either of the two species. It is to be noted that I am speaking here of specimens observed in full vigour;

in spite of this my attempts remained fruitless, albeit I employed the most energetic methods—rapid cuts, inflicted in succession upon the same femur; then the effect of burning, until the limb was reduced to a simple stump. Sometimes I lifted the insect by this stump and shook it violently. The result of this was a tearing of the membrane situated between the thorax and the coxa, or, more often, of that which unites the coxa to the trochanter. This tear presented very irregular contours, with a bunch of muscular fibres detached by the tension.

I must further make mention of the longer or shorter interval that elapses between the production of the stimulus and the detachment of the limb. This interval, which is sometimes less than one second, may also extend to as much as ten minutes.

To recapitulate: autotomy is clearly exhibited in the case of *Monandroptera inuncans*, and especially in *Rhaphiderus scabrosus*, but in an irregular, or even, one might say, in a capricious fashion. The limbs belonging to the anterior pair are usually those which most readily become detached. In these insects, however, autotomy is never produced so easily as in the saltatory Orthoptera, such as the grasshoppers, whose great posterior legs always detach themselves so quickly when the femur is pinched, even very slightly, or when it is suddenly cut through. Lastly, while in the case of the grasshopper it is the contraction of a single muscle or of a small number of muscles that causes the rupture, in the Phasmidæ the latter takes place only after very vigorous muscular contractions affecting the entire body. These contractions are more violent in the females than in the males. In the enormous heavy females of *Monandroptera inuncans* especially they are very remarkable, and in such cases there sometimes takes place, after the rupture, a loss of blood more considerable than usual, represented by a large greenish drop. This hæmorrhage, although arrested pretty quickly by coagulation, is nevertheless sufficient, if it again ensues owing to the loss of three or four other limbs, to cause flaccidity of the body and the death of the insect after an interval of from twelve to twenty hours.

When autotomy is produced by the bite of the ants it may be followed by hæmorrhage if the insect be abandoned to its aggressors for a few minutes, since, by their repeated bites inflicted upon the raw wound, they prevent the coagulation of the blood.

LVI.—*Diagnosis of a new Subspecies of Gazelle from British East Africa.* By Oldfield Thomas.

Gazella Grantii notata, subsp. n.

Closely allied in essential characters to the typical *G. Grantii*, but distinguished by the greater length, breadth and intensity of both the dark and light lateral bands—the former black, the latter light buff and edged above posteriorly with a second dark band, less dark than the main lateral band, but much darker than the centre of the back. Pygal band broad, deep black.

Hab. West slope of Lorogi Mountains, British East Africa.

Type Brit. Mus. no. 97. 1. 30. 2. Killed Oct. 9, 1895. Collected and presented by Arthur H. Neumann, Esq.

This handsome gazelle has also been obtained in the same region by Mr. H. S. H. Cavendish.

BIBLIOGRAPHICAL NOTICES.

A Dictionary of Birds. By Alfred Newton, assisted by Hans Gadow; with Contributions from R. Lydekker, C. S. Roy, and R. W. Shufeldt. London: A. & C. Black.

When the publication of the ninth edition of the 'Encyclopædia Britannica' was commenced many of its readers saw with dismay the treatment accorded to the Birds; but by the time the word "Bullfinch" was reached a change of author had evidently taken place, and an admirable series of articles followed over the initials A. N. The most important of these was, perhaps, the treatise entitled "Ornithology," and suggestions were made in several quarters that on the conclusion of the Encyclopædia a revised issue of these articles in octavo form would be desirable. By degrees the publishers adopted this view, and in 1893 appeared Part I. of the present work, while the end of 1896 witnessed the conclusion of Part IV. It is hardly necessary to say that, owing to the self-exacting character of Prof. Newton, the original articles formed little more than a foundation, many of those in the present series having practically been rewritten, while others have been added; the result being a work of which it would be difficult to speak too highly. It is, moreover, a fascinating book, for a search under a definite heading is sure to lead to the perusal of some other article, perhaps far apart from the original objective—in which respect it resembles Yule and Burnell's 'Glossary of Anglo-Indian Words,' or the more severe 'Etymological Dictionary' of Prof. Skeat.

We do not think it too much to say that beyond all living ornithologists Prof. Newton is familiar with the works of the earlier

travellers, seafarers, and explorers, such as Oviedo, Leguat, Dampier and Carteret, as well as with later writers; while he has scarcely a rival in respect of the birds of the Shakesperean epoch. Under the heading "Extermination" he gives a sadly picturesque summary of the "passing" of many species which formerly inhabited the Mascarene Islands: among these being not only the comparatively notorious Dodo and the Solitaire, but also an allied Didine bird, as well as at least two species of Parrot, a Dove, a large Coot, and another Ralline bird (the flightless *Aphanapteryx*), an Owl, a Heron, &c. The abnormal Starling (*Fregilupus*) of Réunion survived until about forty years ago, and a remnant of the Parrakeet (*Palæornis exsul*) of Rodriguez is still awaiting the doom of its predecessors. In the West Indies, owing to the intervention of civilized man, quite as many species have died and made no sign. In our own days the Great Auk or Gare-Fowl has attained a melancholy celebrity, owing to its being classed as a "British" bird and the producer of eggs sold at sensational prices; but the Labrador Duck, the Phillip-Island Parrot, the *Mamo* of the Sandwich Islands, and others are quite as worthy of note, though their end has been more obscure. The important article on "Geographical Distribution" covers upwards of fifty pages, and is illustrated by a map showing approximately the six zoogeographical regions; the number being the same as proposed by Mr. P. L. Sclater in his well-known scheme, but the Palæarctic and Nearctic of the latter are united by Prof. Newton under the heading Holarctic, while a New Zealand Region is added. For this modification strong—and, to our mind, convincing—reasons are adduced. The subject of "Migration" is treated with characteristic caution as regards the broad lines, and even on a matter of detail it is, perhaps, rash on our part to "rush in" with a suggestion that the absence of any evidence as to the halting of the Red-spotted Bluethroat (*Cyanecula suecica*) on its transit between Egypt and the shores of the Baltic may be due to the absence of observers along the route adopted by that little bird. Prof. Collett has pointed out that this species reaches its breeding-grounds in Norway from the east, and never follows the western coast-line; while a glance at the map will show that between the meridians of 28° and 35° E. (a fair "mean") there is very little chance of any resting-place on passage being noticed. Where are the recorders of Kishineff and Kieff, of Minsk or Vitebsk? The western race of Bluethroat with the white spot can be traced resting on its gradual passage northward in spring, and it seems improbable that a form merely differing in respect of its chestnut-coloured spot (in the male) should adopt the violent measure of rushing across Europe, precisely where that continent is broadest and where the congenial natural conditions seem to invite a stay for repose and food.

The Introduction, which, of course, appeared in Part IV., consists (with its separate Index) of 124 pages, and is a masterly review of the progress of Ornithology from the dawn of science to the present time. Amusement as well as instruction is afforded by the descrip-

tion of the Quinary System—the Swedenborgianism of ornithology—adopted in the days of Vigors, Swainson, W. S. Macleay, and Oken; while an attempt is made to claim tardy justice for the honest work of L'Herminier, neglected by his contemporaries, who were busied with futile systems. Matter worthy of serious consideration, however, begins with the enunciation by Huxley of the theory now generally accepted, namely that Birds are descended from Reptilian forms; and the treatise of that distinguished naturalist, as well as the schemes of classification proposed by his successors, are here analysed with remarkable lucidity. An important feature consists in the prominence given to Prof. Fürbringer's contribution to Systematic Ornithology, published in 1888: a work which does not seem to have obtained from British naturalists the attention it deserves. His researches (to quote Prof. Newton) "put the Reptilian pedigree of Birds and the position of the Ratitæ in a wholly new light, incidentally proving the latter to be derived from ancestors fully endowed with wings." It should be mentioned that Prof. Marsh's Odontornithes had already been discussed, and that Prof. Fürbringer's position does not upset Prof. Marsh's contention that the first Birds had not the faculty of flight. "It only makes evident that between the volant forefathers of the modern Ratitæ and the very first Birds there intervened an indefinite but great number of forms, of which few, if any, traces are known to us, and that the origin of Birds is far more remote than we had been inclined to suppose. Birds, considers Prof. Fürbringer, since they spring from Reptiles, must have begun with toothed forms of small or moderate size, with long tails and four Lizard-like feet, having distinct metacarpals and metatarsals, besides well-formed claws, while their bodies were clothed with a very primitive kind of down." He traces the development of these forms to their gradual attainment of the faculty of flight, and their improvement in that direction, until we find the type of the higher or better Birds of Flight established in the Cretaceous *Ichthyornis* and including the vast majority of existing Birds commonly grouped as Carinatæ. But during the period that the higher and lower types were being differentiated came a retrograde movement and a dwindling of the volant power—the drift of the evidence being that the Ratitæ are not entitled to be considered a distinct subclass, but that they diverged from their flying ancestors at different epochs. Such seem to be some of the principal points in Prof. Newton's excellent epitome; and if in the space at our disposal we have done him an injustice, the reader must apply the antidote by reference to the original (pp. 100–105). For the Author's able review of the present position of the taxonomy of Birds, pp. 108–120 must be carefully studied.

To the present work Dr. Hans Gadow has contributed many valuable articles on Anatomy: such as Colour, Embryology, Feathers, Digestive, Muscular, and Vascular Systems, Pterylosis, Skeleton, &c., these being distinguished by Italic type. Mr. R. Lydekker has ably undertaken the Fossil Birds; an article on Flight by the late

Prof. C. S. Roy contains the clearest explanation of aerial motion with which we are acquainted; and Dr. Shufeldt, formerly of the United States Army, has assisted. It only remains to say, as an indication of the care bestowed upon the work, that the Notanda et Corrigenda occupy nearly 4 pp. of small print.

Trouessart's 'Catalogus Mammalium.' Fasciculus III., completing the Rodentia, pp. 453–664. Berlin, 1897.

The issue of the third fasciculus of this important work so closely following the second shows that the author is well advanced with his material. Needless to say, the present part maintains the high level of its predecessors, and Dr. Trouessart is to be congratulated on having got through such a difficult group as the Rodentia, especially when fossil forms have to be wedged in among their recent relatives.

In this section the author has had the advantage of consulting Mr. Thomas's recent revision of the Rodentia, which appeared too late for incorporation in the preceding part. While adopting the revision to a great extent, Dr. Trouessart has seen reason to depart from it in some particulars: notably, he refuses to admit the supersession of the familiar *Myoxus* by the forgotten *Glis*, and consequently retains Myoxidæ in place of Gliridæ. Whether the reasons he gives for the retention will be accepted by the "innovation school" remains to be seen: it is to be hoped they will. Most zoologists will be glad to see that *Cricetus* retains its place against *Hamster*; and it appears that this settlement rests on a firmly established basis of fact. The adoption of the barbarous *Couendu* for the South-American Tree-Porcupines is, however, distinctly to be regretted, and still more so the substitution of the new Coendidæ for the Erithizontidæ of Mr. Thomas. It appears that the reason for this substitution is the mistaken notion that the earliest generic name in a family must necessarily be the one from which the family name is taken.

In regard to extinct forms, it is a pity that the author regards the Tertiary beds of Patagonia as of Eocene age, and still more so that he admits the endless host of nominal species which have been named by the Argentine palæontologists.

It is also a subject for regret that the references to the various genera throughout the work have not been given, instead of merely the date of publication. Errors and misprints are exceedingly few; but since the author adheres to the original spelling of names, there is no doubt that *Limacomys* (p. 470) should stand as *Leimacomys*, although the former is really the proper way of transliterating.

We look forward to have ere long the pleasure of congratulating Dr. Trouessart on the completion of his arduous task. R. L.

MISCELLANEOUS.

Note on the Dates of "The Zoology of the 'Beagle.'"

Gentlemen,—By the courtesy of Messrs. Smith, Elder, and Co., I was enabled, in August 1895, to ascertain the contents and dates of the separate parts of "The Zoology of the 'Beagle.'" I append the data for the convenience of other workers; and as the items in column 4 of Messrs. Smith, Elder, & Co.'s report include titlepages, fly-sheets, &c., I have added in square brackets the actual text pagination for greater clearness.

Parts.	Contents.	Plates.	Pages.	Date.
1	Foss. Mamm.	7	46 [1–40]	Feb. 1838.
2	Mamm.	10	16 [1–16]	May ,,
3	Aves.	10	16 [1–16]	July ,,
4	Mamm.	8	24 [17–32]	Sept. ,,
5	Mamm.	8	16 [33–48]	Nov. ,,
6	Aves.	10	16 [17–32]	Jan. 1839.
7	Foss. Mamm.	10	32 [41–68]	Mar. ,,
8	Foss. Mamm.	10	16 [69–80]	May ,,
9	Aves.	10	24 [33–56]	July ,,
10	Mamm.	9	60 [49–100]	Sept. ,,
11	Aves.	10	40 [57–96]	Nov. ,,
12	Pisces.	8	32 [1–32]	Jan. 1840.
13	Foss. Mamm.	5	36 [81–112]	Apr. ,,
14	Pisces.	7	32 [33–64]	June ,,
15	Aves.	10	76 [97–164]	Mar. 1841.
16	Pisces.	5	32 [65–96]	Apr. ,,
17	Pisces.	9	92 [97–172]	Apr. 1842.
18	Rept.	10	16 [1–16]	Aug. ,,
19	Rept.	10	44 [17–52]	Oct. 1843.

C. Davies Sherborn
('Index animalium').

White Ants; with some Account of their Habits and Depredations.

By Walter W. Froggatt, New South Wales Government Entomologist.

Specimens of potatoes were received from Mr. Broughton Corrie, Colo Vale, about the middle of February, with the information that when harvesting his crop he had found those in one corner of the field covered with white ants, which were burrowing into and gnawing the centres out of otherwise perfectly sound tubers; but as none of the insects were sent with this consignment, further information was asked for.

In response to my request, further samples of potatoes were sent down swarming with live soldiers and workers of these destructive little creatures, and so honeycombed with their attacks that only

the outer surfaces were solid. Shortly afterwards I paid a visit to Mr. Corrie's farm, and made the following observations :—

The bulk of the potatoes had been harvested, but a few remained undisturbed in the corner infested, and every one we turned over was more or less riddled with ant-holes. The field in which the crop had been planted was new land, only cleared the previous season, and still containing a number of the larger stumps, while about 30 yards from the corner of the paddock there was a large white ants' nest (termitarium), which, partly covering a large stump, reached to about 5 feet in height, and when cut down was found to be swarming with termites in all stages of development. There is not the least doubt that it was foraging parties from this nest that had invaded the paddock.

This termite upon examination proved to be our commonest Sydney species, which is responsible for nearly all the damage done to houses in the city and suburbs. It belongs to the typical genus *Termes*, and in a concluding paper in my "Monograph of the Australian Termitidæ," being published in the 'Proceedings of the Linnean Society of New South Wales,' I propose to call it the "Milk Termite" (*Termes lactis*, sp. n.), on account of the soldiers ejecting a globule of milk-like fluid when disturbed. It was this species that destroyed the roof of the Australian Museum last year, and two years before eat out the floor of the records office in the buildings of the Department of Education in Bridge Street. The same termites are to be found destroying the woodwork of the hot-houses in the Botanic Gardens; and in nearly every instance where the white ants have been sent in from buildings about Sydney they have proved to belong to this species.

In the immediate vicinity of Sydney these termites do not build mound-nests, but are found under logs or stones, gnawing the bark off dead trees, or in small communities about the trunks of trees; but upon the Blue Mountains and all over the Shoalhaven district they build large regular mound-nests.

These termitariums measure from 2 to sometimes 6½ feet in height, broadest at the base, and tapering slightly to a rounded summit. The outer surface consists of a solid earthern wall, often from a foot to 18 inches in thickness, formed of particles of earth gathered upon the surrounding surface and cemented together with the excreta of the workers voided while placing the earth in position. This wall encloses a compact woody mass, slightly separated from it on the sides, but almost touching at the apex. This central portion varies in different parts of the nest in its structure, but chiefly consists of titurated wood that has been eaten and passed through the bodies of the termites, and has a regular foliated structure, these lumps forming a coarse irregular honeycomb. The cap is composed of rounded irregular lumps, but towards the centre, about 6 inches from the ground-level, there is a soft papery-like mass about the size of a man's head, composed of fine sheets folding round each other and full of holes and irregular galleries: this is the nursery, where all the very small larvæ live after they have

hatched out. The eggs, which look like grains of sugar, will be found piled up on the edge of a terraced formation where it joins the nursery. Here the queen's cell is situated, somewhat about the shape and size of an inverted saucer, and surrounded by other terraced cells. Where the base of the nest comes in contact with the ground it forms a coarse network of cells with galleries leading downward into the earth, from which they gain access to the outside world.

All these mounds are in the first instance formed over a dead stump or fallen log, which in the course of time is by the action of the termites transformed into this triturated woody material. The social life and transformations of the different forms found in these nests is very remarkable, and has puzzled naturalists from earliest ages. Pliny, in his 'Natural History of the World,' where all the curious and remarkable "facts" known to the ancients are recorded, gives the following account of the "Indian Pismires," which is probably intended for white ants:—

"In the country of the Northern Indians, named Dardae, the ants do cast up gold above the ground from out of holes and mines within the earth; these are in colour like to cats, and as big as the wolves of Egypt. This gold beforesaid, which they work up in the winter time, the Indians do steal from them in the extream heat of summer, waiting their opportunity when the pismires lie close within their caves under the ground from the parching sun, yet not without great danger. For if they happen to wind them, and catch their scent, out they go, and follow after them in great haste, and with such fury they fly upon them, that oftentimes they tear them in pieces, let them make way as fast as they can upon their most swift camels, yet they are not able to save them, so fleet of pace, so fierce of courage are they, to recover the gold they love so well."

Each nest contains three very distinct classes or castes. First, the winged males and females, which hardly differ in general appearance from each other, and are popularly known as "flying ants." They are developed from the eggs by a gradual series of moults, and when about half-grown show well-formed wing-cases. The nests during the winter months are full of these termites in all stages of growth, and early in November they undergo their final moult and emerge with two pairs of full-grown wings. The workers now cut regular galleries through the earthen walls, which are guarded by the soldiers until the time comes for them to all fly from the nest. The bulk of them are destroyed by birds and hundreds of other insects that prey upon these helpless creatures, while thousands of them perish around lamps and fires. A few pairs, however, manage, after shaking off their wings (which have a curious cross suture close to the shoulders by which they are very easily pulled off), to crawl under a log, where, if they manage to exist until they are found by a foraging party of workers and soldiers, they found a fresh colony.

What becomes of the male termite after the female becomes pregnant I do not know, as I have never been able to find him in a

well-developed nest; but the female, which is popularly known as the "queen white ant," as soon as she is settled in her cell, often called the "royal chamber," begins to lay eggs, and while the head and thorax remain at the normal size, her abdomen swells out into a cylindrical rounded white mass as thick as a small pea-pod, which renders her quite helpless and incapable of crawling about. The body now consists of a great number of egg-tubes or ovaries, leading into the egg-laying duct, and from this single insect flows the whole life and reproductive power of the colony. The queen is carefully fed and looked after by the workers, who remove the eggs into adjoining galleries between her cell and the true nursery previously described. The queen may lay eggs for some years, but I do not think either at the rapid rate or for so long as many of our popular writers have asserted, for the workers have the power (probably in the method of feeding the young larvæ) of producing supplementary queens, which never pass through the winged form, but are produced direct from the egg, and probably supersede the queen in cases of emergency, when she has outlived her usefulness or been accidentally destroyed.

The workers, which constitute the bulk of the members of every nest, are aborted females and males (and not only females, as among the bees), whose duties are to do all the building and repairing of the nests, look after the queen, eggs, and larvæ, and all other work in the community; and it is to the powerful jaws of this form that we are indebted for their destructive habits. They measure about 2 lines in length, of a uniform dull white colour, with large rounded heads sometimes tinted with pale yellow; the antennæ formed of a number of rounded bead-shaped segments and a rounded upper lip which covers the short powerful jaws; the thorax is comparatively small; the legs short and stout, armed with fine spines at the base of the shanks; and the abdomen large and rounded.

The soldiers are also aborted males and females, and are never as numerous as the workers. Their duties are to protect the nest and drive off any enemies that appear when it is damaged or broken into, and direct the labours of the workers when adding to or mending gaps in the outer surface of the nest.

They are more slender in form than the workers, with the head pear-shaped and the jaws produced into two stout scissor-like jaws, while above them in the centre of the head is a small cylindrical opening connected with a chamber at the base of the head, through which they can eject the white fluid previously mentioned, which is also a weapon of defence against their enemies.

In these remarkable households it is the blind leading the blind, for neither the soldiers or workers are furnished with eyes, and all their movements must be directed by their delicate sense of touch, for when mending a gap in the nest the soldiers always form themselves into a regular row, standing just far enough apart for them to touch the tip of each other's antennæ, which are constantly

moving, while each worker comes between the soldiers and deposits its load, returning until the breach is closed.

Besides the above-described forms, there are always a great number of immature termites all over the nest, from the tiny larvæ just hatched from the eggs to the pupæ with their wing-cases reaching down to the middle of the back.—*Agricultural Gazette of New South Wales*, May 1897, pp. 297–300.

Care of the Brood in Psolus antarcticus.

By Prof. Hubert Ludwig, of Bonn.

I am already once more able to report a hitherto unknown case of care of the brood in Holothurians, and again it is a question of an antarctic species and of a form of care of the brood which is new for Holothurians. Although since its first description by Philippi (1857) *Psolus antarcticus* has been on several occasions the subject of observation and study, for it has been investigated by Studer (1876), Théel (1886), Lampert (1889), and myself (1896), nothing whatever had been learnt of the existence of care of the brood in this species. It is true that we have been told by Wyville Thomson (1876) that another antarctic *Psolus*, Thomson's *P. ephippifer*, brings up its young beneath the dorsal plates modified for this purpose; but that the longest-known antarctic species of *Psolus*—*P. antarcticus* (Phil.)—the range of which extends from Payta (Peru) southwards as far as Cape Horn, also belongs to the forms which care for their brood is an unexpected discovery. The score of large and small specimens that Dr. Michaelsen has brought home from the Hamburg-Magellan Collecting Expedition * include ten small and medium-sized examples which were collected on July 9, 1893, in Smyth Channel (north-east of the Straits of Magellan); among these I met with two which to my surprise carried their young on the ventral side, which is flattened to form the creeping sole.

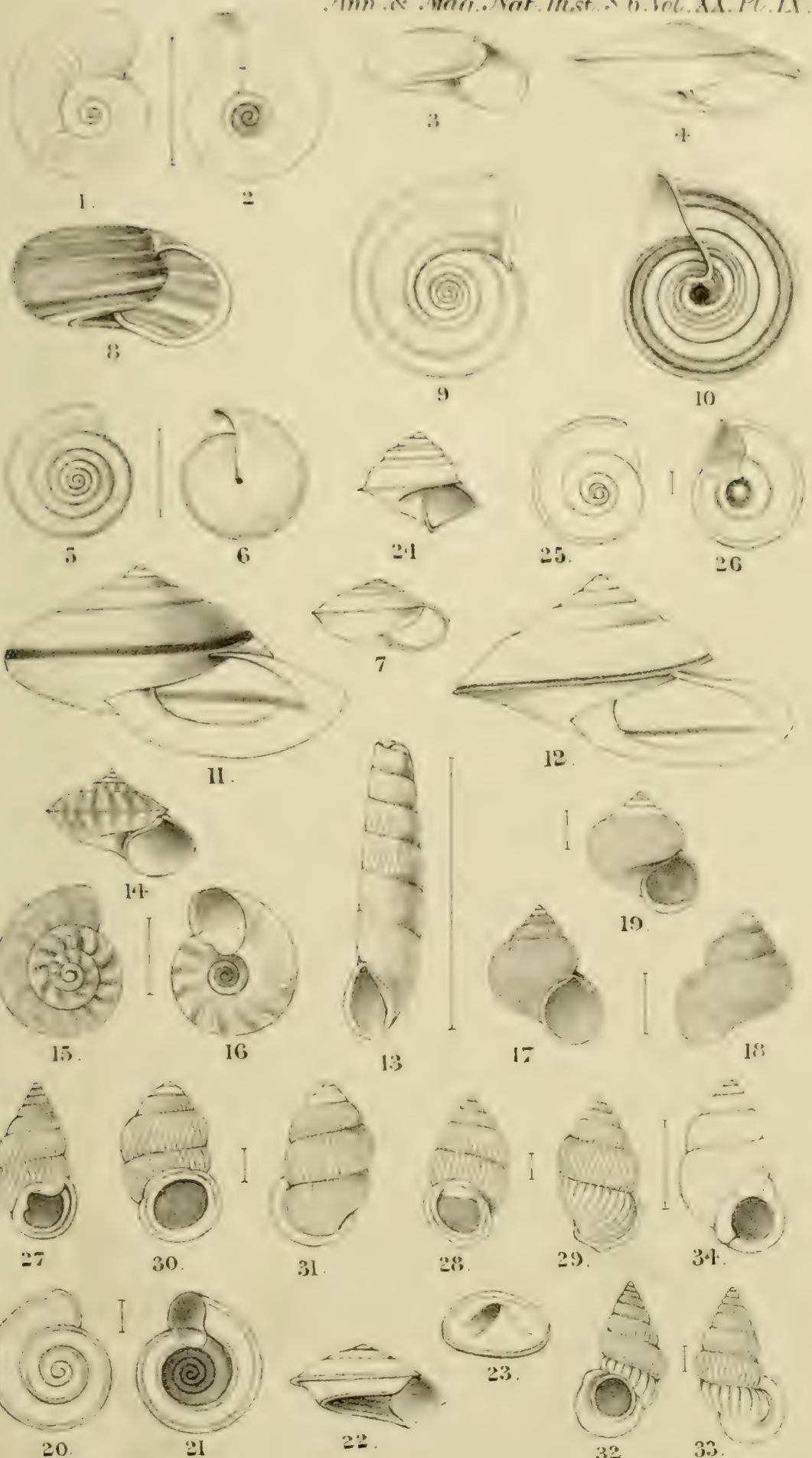
In the specimen which is the better preserved of the two and measures 12·5 millim. in length by 8·5 millim. in breadth I find almost one half of the creeping sole occupied by young animals (twenty-two in number), which are all in the same stage of development and are attached by their pedicels to the area of the sole which is bare or devoid of pedicels. The pedicels of the adult animal are not touched by the young; moreover, no young are to be found on the outside of the maternal pedicel-zone. While care of the brood is in progress the mother can move about as freely as ever or can attach itself and adhere firmly to its support. Contrary, therefore, to what

* It was in the material obtained by this expedition that I also discovered care of the brood in the case of *Chiridota contorta*, as recently reported by me ('Zool. Anzeiger,' Bd. xx. 1897, no. 534, pp. 217–219 [Ann. & Mag. Nat. Hist. ser. 6, vol. xx. 1897, pp. 327–328]).

we find in *Cucumaria crocea*, Less., where, moreover, the young are borne not on the ventral but on the dorsal surface, ambulacra do not have to assist in the care of the brood. The young are attached close together in a single layer to the median area of the creeping sole, which is hedged round by the pedicels; if they be detached, the spots they previously occupied are indicated only by slight impressions.

The young average but 1·5 millim. in length and barely 1 millim. in breadth, but are nevertheless already well developed, so that they represent a tiny copy of the adult animal. The arched dorsal surface already possesses a closed armature of imbricated calcareous plates, among which the five oral plates can clearly be distinguished. In their development these dorsal plates pass through a stage which is retained permanently by the calcareous bodies in the ventral integument of the adults. The flat ventral side is encompassed by a single (not yet double) series of twenty pedicels, which are already equipped with a relatively large terminal disk and some supporting plates. These pedicels develop later on into the inner series of larger pedicels which we find at the margin of the ventral surface of the adults, while as yet there have appeared no rudiments of the series of much smaller external pedicels. In the ventral integument the formation of the calcareous bodies has only just begun. In the calcareous ring there can already be recognized five radial and five interradial pieces, similar in form to those in the adults: towards the radialia there already extend distinct retractor muscles. Moreover the full complement of tentacles (ten) is already present, and they contain in their walls a few small cribriform plates. A calcified madreporic plate belonging to the stone-canal is developed. The intestine is coiled in the same way as it is subsequently. Of respiratory trees, however, no rudiments appear yet to have come into existence, nor can I yet observe any trace of the genital organs.

The number of Holothurians which care for their brood consequently now amounts to nine, including five antarctic and one arctic species. Not only is the relatively large number of the antarctic forms exceedingly striking, but almost even more remarkable is the circumstance that in each of the five antarctic species the care of the brood is effected in a different way. In *Psolus ephippifer* the young develop beneath the dorsal plates, in *Cucumaria crocea* upon the modified dorsal ambulacra, in *Psolus antarcticus* upon the ventral creeping sole, in *Cucumaria lævigata* in ventral brood-pouches, and, lastly, in the case of *Chiridota contorta* in the genital canals.—*Zoologischer Anzeiger*, Bd. xx. no. 535 (July 5, 1897), pp. 237–239.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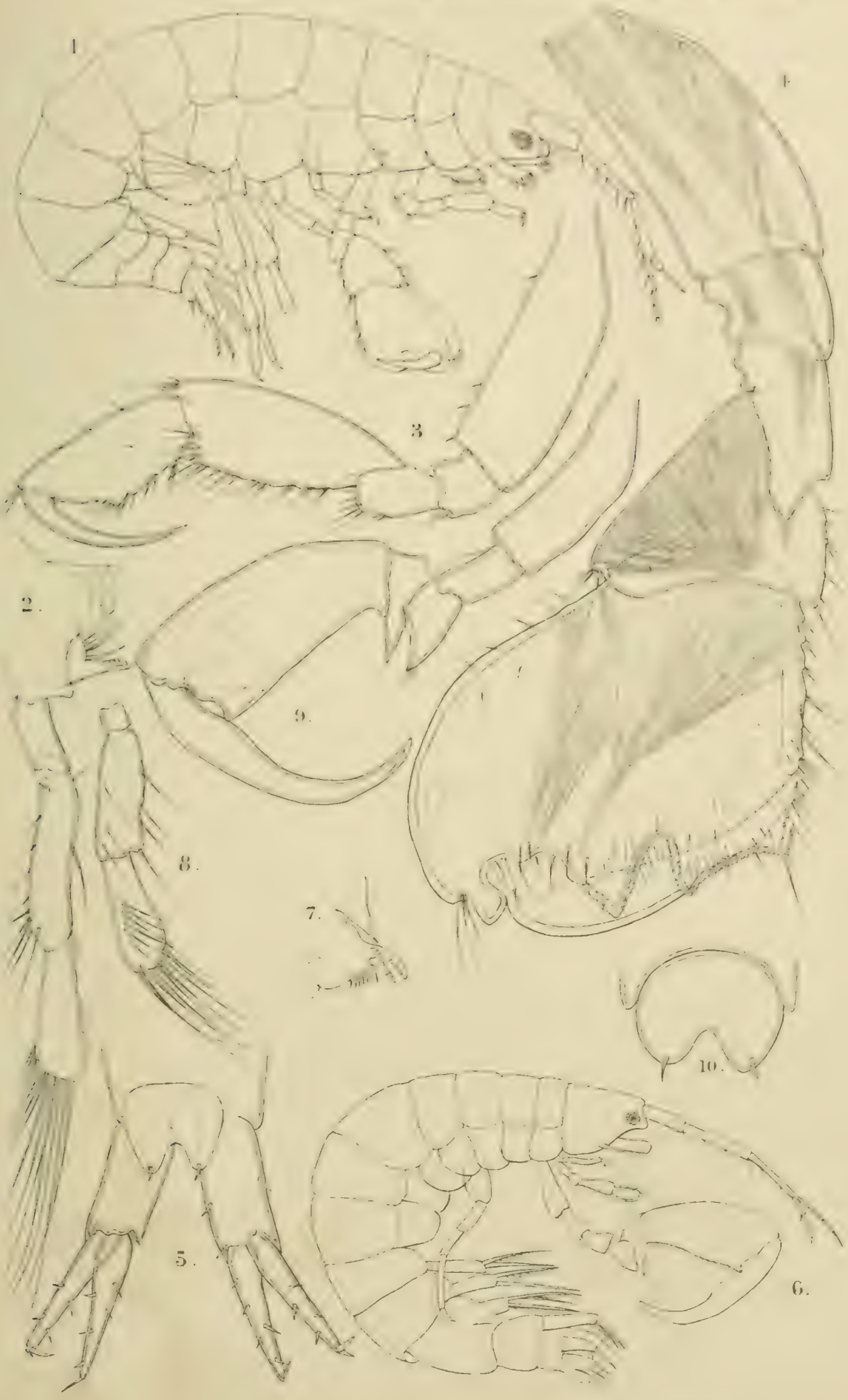

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 120. DECEMBER 1897.

LVII.—*Notes on* Sunaristes paguri, *Hesse, and some other rare Crustacea.* By Thomas Scott, F.L.S., Naturalist to the Fishery Board for Scotland, and Andrew Scott, Fisheries Assistant, University College, Liverpool.

[Plates XI. & XII.]

In 1893 we described * under the name of *Canuella perplexa* an apparently new Copepod that had been observed in the Firth of Forth. In our description of this Copepod we referred to a certain similarity between it and *Sunaristes paguri*, Hesse—a species that M. Hesse had discovered living as a parasite on a *Pagurus* sp. (now *Eupagurus*). We at the same time pointed out some differences which we considered warranted us in describing the Copepod from the Firth of Forth under a new generic name.

We had not at that time seen specimens of *Sunaristes*, but had been guided in our decision by the description and figures of the parasite published by M. Hesse, supplemented by those of Herr W. Müller, who, subsequent to, but evidently unaware of, M. Hesse's discovery, had, under the name of *Longipedina paguri*, also figured and described this crustacean.

Having been successful during the past year or two in obtaining several British specimens of *Sunaristes*, both male and female, we have by an examination of these been enabled to prepare the following notes and drawings, showing the

* Ann. Scot. Nat. Hist. vol. ii. p. 92, pl. ii. figs. 1–3 (Oct. 1893).

more important points of difference between this parasitic Copepod and *Canuella*, and also the close relationship between these two and the genus *Longipedia*, Claus.

Sunaristes paguri, Hesse.
(Pl. XI. figs. 1–10; Pl. XII. figs. 2–7.)

1867. *Sunaristes paguri*, Hesse, Ann. des Sci. Nat. sér. 5 (Zool.), vol. vii. p. 205, pl.
1884. *Longipedina paguri*, W. Müller, Archiv für Naturg. Jahrgang 50, Band 1, p. 19, pl. xiii.

Description of the Female.—Figure 1 (Pl. XI.) represents an adult female of *Sunaristes paguri* from the Cromarty Firth; it is an elongate and comparatively slender Copepod, and measures fully 3 millim. ($\frac{1}{8}$ of an inch) in length, exclusive of tail-setæ; the first body-segment is somewhat more robust than the others, the rostrum is large and conspicuous; the first abdominal segment, which is about equal in length to the second and third together, is composed of two completely coalesced somites, and is provided with hook-like appendages on the underside and near the proximal end (fig. 4, Pl. XII., exhibits these appendages seen ventrally); the caudal stylets are fully twice the length of the last abdominal segment.

The antennules (Pl. XI. fig. 2) are short, moderately stout and setose, and consist of five more or less subequal joints, but the penultimate joint is rather shorter than the others. The antennæ (Pl. XI. fig. 3) are similar to those of *Canuella* and *Longipedia*. The mandibles (Pl. XI. fig. 4) and other mouth-organs (Pl. XI. figs. 5–7) also closely resemble those of the same two genera. The swimming-feet resemble those of *Canuella*, except that the inner branches of the fourth pair are proportionally somewhat shorter (see Pl. XII. figs. 2 and 3, which represent the first and fourth pairs). The fifth pair (Pl. XI. fig. 8), which are somewhat rudimentary, are each furnished with a long and moderately stout seta on the outer angle and with three elongate spines interiorly.

Description of the Male.—The antennules of the male *Sunaristes* (Pl. XI. fig. 10), which, like those of the female, are short and stout, terminate each in a strongly developed hand with a stout brownish-coloured movable claw; they form powerful grasping organs and by their robust structure give the Copepod a somewhat remarkable appearance. The antennæ, mouth-organs, and swimming-feet are all more or less similar to those of the female, with this important exception, that the first two joints of the inner branches of the second pair of feet are produced distally into strong and somewhat spiniform processes that extend almost to the extremity

of the third joint (Pl. XII. fig. 5); these prolongations, especially those of the first joints, are, like the terminal claws of the antennules, of a brownish colour. The first two somites of the male abdomen are not coalesced as in the female, and therefore the male has five abdominal segments; the first segment being of somewhat greater depth than the next one, extends beyond it on the underside. The first body-segment in the male is proportionally rather more robust than the same segment in the female, but in other respects male and female are much alike in general appearance (Pl. XI. fig. 9); the male specimen represented by fig. 9* measured fully 2 millim. ($_1^1{}_2$ of an inch) in length, exclusive of tail-setæ, being about one third shorter than the female.

Remarks.—It is evident from the foregoing description that there is a considerable resemblance between the two genera *Sunaristes* and *Canuella* and, in some respects, between these and *Longipedia*; the antennules, antennæ, and the whole of the mouth-organs of the females in the three genera are all nearly alike; the same may to some extent be also said of the males; moreover, the swimming-feet of the females belonging to the three genera (with the exception of the second and fifth pair in *Longipedia*) are all very similar; but though the three genera *Sunaristes*, *Canuella*, and *Longipedia*, and especially the first two, resemble each other so closely in many of their structural details, there are also the following important differences to be observed:—The female *Sunaristes* differs from the females of *Canuella* and *Longipedia* in having the first two somites of the abdomen completely coalesced. The female *Longipedia* differs from the female of *Sunaristes* and *Canuella* in having the inner branches of the second pair of swimming-feet greatly elongated, being from two to nearly three times the length of the outer branches (in the male of *Longipedia* the inner branches of the second pair are also elongate). The male *Sunaristes* differs from the male of *Canuella* and *Longipedia* not only in possessing more powerfully armed antennules, but also in the peculiar prolongations of the first and second joints of the inner branches of the second pair of swimming-feet. The male of *Canuella* differs from the male of *Sunaristes* and *Longipedia* in having both branches of the second pair of swimming-feet short and similar in structure to those of the female. On the other hand, *Longipedia* differs from the other two in the form of the fifth pair of thoracic feet in both sexes.

* This specimen was obtained near the mouth of the River Mersey. It would thus seem that *Sunaristes* is partial to brackish water conditions.

After a careful study of the structure of all these three forms, it seems to us that, though the affinity between *Canuella* and *Sunaristes* is very close, yet the differences that separate them are too important to be regarded as of merely specific value, and that we are therefore justified in still retaining *Canuella* as a distinct genus.

The following is a tabular arrangement of the more important differences that distinguish the three genera :—

Genus.	Male antennules.	Inner branches of second pair of swimming-feet.	Fifth pair.	Abdomen of female.
Longipedia..	Feebly clawed.	From two to nearly three times the length of the outer branches and nearly alike in both sexes (end-joints greatly elongated).	Small, foliaceous.	Composed of fi segments, as the male.
Canuella....	Feebly clawed.	Of about the same length as the outer branches and alike in both sexes.	Rudimentary.	Composed of f segments, as the male.
Sunaristes ..	Strongly clawed.	Of about the same length as the outer branches; in the male the first and second joints are produced into strong spine-like processes.	Rudimentary.	Composed of fo segments (first consist of two co pletely co esced somite in the m composed five segment

Note on Remigulus tridens, *T. and A. Scott.*

In October 1893 we published * a description, with figures, of a somewhat curious Copepod from Loch Linnhe, Argyllshire. It was described under the name of *Remigulus tridens*, gen. et sp. n., as no previous record of its occurrence was at the time known to us; and from certain peculiarities of structure observed we stated in our remarks of the Copepod that, "though obtained amongst dredged material, its structure clearly indicates semiparasitic habits similar to the Lichomolgidæ and other allied forms." A considerable time after our description was published we ascertained that MM. Canu and Cuenot, in a memoir entitled "Commensaux

* Ann. & Mag. Nat. Hist. ser. 6, vol. xii. p. 242, pl. xi. figs. 15–20, pl. xii. figs. 1–3 (Oct. 1893).

parasites des Echinodermes" *, had described under the name of *Synatiphilus luteus* a Copepod parasite which appears to be identical with the form we have recorded from Loch Linnhe; and as MM. Canu and Cuenot's memoir was published in 1892, *Remigulus tridens* necessarily becomes a synonym of *Synatiphilus luteus*, Canu and Cuenot.

Diaptomus laciniatus, Lilljeborg. (Pl. XII. fig. 1.)

A freshwater Copepod from Loch Doon, Ayrshire, new to Britain.

This species of *Diaptomus* is readily distinguished from any other member of the genus in the British fauna by the peculiar form of the last two thoracic segments in the female, as well as by the difference in the structure of the fifth pair of thoracic feet in both sexes.

Figure 1 (Pl. XII.) represents a female specimen seen from above, and shows the peculiar form of the last two thoracic segments referred to; this specimen measured 1·8 millim. ($_{1}^{1}_{4}$ of an inch) in length. MM. Jules de Guerne and Jules Richard, in their revision of the freshwater Calanidæ, when referring to the characteristic form of the last two thoracic segments in *Diaptomus laciniatus*, say:—"Ce *Diaptomus* se distingue au premier coup d'œil de tous les autres par la forme des deux derniers segments thoraciques."

This Copepod occurred very sparingly in the gathering from Loch Doon, while another species of the same genus—*D. gracilis*, G. O. Sars—was of frequent occurrence. There does not appear to be any previous British record of *D. laciniatus*, but on the continent it has been found at Kola in Russian Lapland and in the vicinity of Bergen in Norway. Prof. Cleve (of Upsala, Sweden) has also collected it in abundance in the Lake of Geneva †. The altitude of Loch Doon is between 600 and 700 feet above the sea.

Lathonura rectirostris, Lilljeborg.

From Loch Doon, Ayrshire; new to Scotland.

In the gathering of Entomostraca from Loch Doon there were, besides *Diaptomus laciniatus*, already referred to, several other species of more or less interest, most of which have, however, been recorded from other parts of Scotland;

* Revue Biol. du Nord de la France (Oct. 1892), p. 19, pl. i. figs. 6 and 7.

† "Révision des Calanides d'eau douce," by Jules de Guerne and Jules Richard, p. 47, separate copy (1887).

but, so far as we know, this is the first time *Lathonura rectirostris* has been observed in a Scottish loch. This Cladoceran appears to be very fragile, for though a number of specimens have been obtained, all are more or less damaged. "The peculiar plates attached to the ventral margin of *Lathonura rectirostris*, instead of the usual setæ or spines, at once serve to distinguish this species from all other Entomostraca with which we are acquainted" (Rev. A. M. Norman and Dr. G. S. Brady in 'Mon. of Brit. Entom. belonging to the families Bosminidæ, Macrothricidæ, and Lynceidæ,' p. 16). The same authors give for this Cladoceran only one locality in the British Islands, viz. Lough Bollard, Connemara.

Note.—Our friend D. J. Scourfield, Esq., Leytonstone, Essex, has just informed us that he has obtained *Lathonura* on two occasions, and has seen specimens of it that were collected at one of the excursions of the Quekett Club to Staines; and adds, "it appears to be a very rare species."

EXPLANATION OF THE PLATES.

Plate XI.

Sunaristes paguri, Hesse.

Fig. 1. Female, lateral view, × 26½. 2. Female antennule, × 127. 3. Antenna, × 124. 4. Mandible, × 127. 5. Maxilla, × 127. 6. Anterior foot-jaw, × 127. 7. Posterior foot-jaw, × 190. 8. Foot of fifth pair, female, × 253. 9. Male, lateral view, × 40. 10. Male antennule, × 127.

Plate XII.

Diaptomus laciniatus, Lilljeborg.

Fig. 1. Female, seen from above, × 27.

Sunaristes.

Fig. 2. Foot of first pair, × 127. 3. Foot of fourth pair, × 84. 4. Appendages of first abdominal segment, female, × 190. 5. Foot of second pair, male, × 127. 6. Foot of fifth pair and appendages of first abdominal segment, male, × 127. 7. Last three abdominal segments and caudal stylets, male, × 40.

LVIII.—*A Revision of the Species of Butterflies belonging to the Genus* Teracolus, *Swains.* By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c.

[Concluded from p. 473.]

67. *Teracolus Hildebrandti.*

Callosune Hildebrandti, Staudinger, Exot. Schmett. p. 45, pl. xxiii. (1886).

From Nyasaland northward to Uganda and eastward to Mombasa.

This species is certainly dimorphic in its wet and dry phases, having the apical patch on the primaries either dull ochreous or bright crimson; it is very closely related to the southern *T. Annæ*, but is, generally speaking, a slightly larger insect with a little less black about it, the female of the wet-season form clearer and more cream-tinted on the under surface of the secondaries. At the same time its dimorphic character is its best one, the crimson-tipped forms (especially the males) of the two butterflies being remarkably similar in every respect. It is curious that just when Mr. Marshall was stating that this species had "only been received from the basin of the Sabaki River," we were receiving a male of the dry-season form from Nyasa, completely proving the specific identity of this species with the crimson-tipped representative of *T. Annæ*, four examples of which from Nyasa stand in the Hewitson series, whilst the Godman and Salvin collection contained seven now transferred to the Museum series. An example of the dry-season form of this variety is recorded by Mr. Marshall in a footnote as *T. Annæ*; yet he professes to distinguish the two species partly by the black inner edging to the apical patch—a very unreliable character, which varies considerably in *T. Annæ* itself.

68. *Teracolus Annæ.*

Thestias Annæ, Wallengren, Kongl. Svensk. Vetensk.-Akad. Handl. 1857; Lep. Rhop. Caffr. p. 66.
Anthocharis Danae, Hewitson (nec Fabr.), Gen. Diurn. Lep. pl. vii. fig. 3 (1847).
Teracolus cinerascens, Butler, Cist. Ent. i. p. 172 (1873).
Teracolus Wallengreni, Butler, P. Z. S. 1876, p. 157.
Callosune Wallengreni, Westwood, in Oates's Matabeleland, p. 341, pl. E. figs. 3, 4 (1881).
Callosune confusa, Westwood, *l. c.* p. 348 (1889).

Ranges from Natal to the Zambesi.

In its wet-season form this is the most heavily marked of all the crimson-tipped *Teracoli*. This form is the typical one, and was named by me as *T. cinerascens* in consequence of Pastor Wallengren's error in describing it as a *Thestias*; *T. Wallengreni=confusa* is the dry-season form; an intermediate form also occurs.

69. *Teracolus Walkeri*.

Teracolus Walkeri, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xiv. p. 403 (1884).

Elephant Bay, S.W. Africa.

This very distinct butterfly was obtained by Mr. J. J. Walker, R.N., about the year 1883. This ardent collector and enthusiastic entomologist appears only to have been able to secure dry and intermediate phases of the species.

T. Walkeri is, in some respects, intermediate in character between *T. Annæ* and *T. pseudacaste*, the primaries of the male above somewhat resembling the wet-season form of *T. Annæ*, but the secondaries, from their less heavily spotted border, perhaps approaching nearer to *T. pseudacaste*; on the whole, however, *T. Walkeri* is far nearer to *T. Hildebrandti* and *Annæ* than to *T. pseudacaste* and *eupompe*.

70. *Teracolus pseudacaste*.

Teracolus pseudacaste, Butler, P. Z. S. 1876, p. 156, pl. vi. fig. 11.
Teracolus phœnius, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 488 (1876).
Teracolus miles, Butler, *op. cit.* ser. 5, vol. xii. p. 105 (1883).

Ranges from the White Nile and Abyssinia southwards to Kilima-njaro.

My three supposed species were all based upon wet-season examples, *T. pseudacaste* being based upon examples obtained on the White Nile probably just after the rainy season, the male lightly but the female heavily marked with black above. *T. phœnius* and *T. miles* are both typical wet-season forms, the former being more heavily marked with black on both surfaces than the latter and showing less crimson in the apical patch, the lowest spot of which is extremely small. The black veining below is sometimes very heavy, especially in females of the wet-season phase, but in the intermediate phase it almost disappears, though in this species the tips of the veins are always blackened in all the phases.

Although the wet-season form of this butterfly and of the allied *T. eupompe* appear to occur together to the north of their range, they differ so markedly in all their phases that I

should no more regard them as synonymous (as Mr. Marshall has done) than I should *Ganoris brassicæ* and *rapæ*. *T. pseudacaste* ranges due southwards, whereas *T. eupompe* appears to follow the north-eastern coast, crossing over from Somaliland to Aden.

71. *Teracolus eupompe.*

Pontia eupompe, Klug, Symb. Phys., Ins. pl. vi. figs. 11–14 (1829).
Anthopsyche theopompe, Felder, Reise der Nov., Lep. ii. p. 183 (1865).
Anthopsyche anteupompe, Felder, *t. c.* p. 184 (1865).
Anthopsyche dedecora, Felder, *ibid.*

Ranges from the White Nile and Abyssinia south-eastwards to Somaliland, and thence across the straits to Aden.

This species in all its phases can easily be distinguished from *T. pseudacaste* by the great reduction of all the black markings on the under surface of the wings, the subapical spots on the primaries and the discal spots crossing the secondaries being almost or wholly obliterated, whilst the red subapical stripe and the red discal spots on the under surface of the secondaries in the female are strongly emphasized. The wet-season form is *T. eupompe*=*anteupompe*; the intermediate phase is *T. theopompe*, having a dry-season upper surface, but a white under surface; whilst *T. dedecora*, in which the apex of primaries and the secondaries below are rosy, is the dry-season phase. The two latter undoubtedly fly together, and in Aden it is tolerably certain that all the phases emerge at the same time as mere variations, which only become seasonally fixed in a more variable climate.

72. *Teracolus dulcis.*

Teracolus dulcis, Butler, P. Z. S. 1876, p. 157, pl. vii. fig. 13.
Teracolus dirus, Butler, *t. c.* pl. vii. fig. 11.
Teracolus eborcoides, Butler, *t. c.* p. 158, pl. vii. fig. 12.
Teracolus immaculatus, Swinhoe, P. Z. S. 1884, p. 443.
Teracolus subroseus, Swinhoe, *t. c.* pl. xl. figs. 6, 7.
Teracolus alberta, Swinhoe, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 356 (1890).

Appears to range from Karachi to Bushire; and one male in the British Museum series is said to have been obtained at Aden, but this I consider very doubtful.

As I do not admit the identity of *T. pseudacaste* with *T. eupompe*, still less can I agree to this purely Asiatic species being the same. As a rule, it may be distinguished at a glance by its narrower and internally arched apical carmine patch, but occasionally a male with a fairly broad patch does occur, though I believe never a female. Another point is that *T. dulcis* has the base of the primaries below

more or less washed with sulphur-yellow, whereas *T. eupompe* and *T. pseudacaste* are uniformly pure white; the veins below are sometimes black-tipped, but never black throughout, and, as already hinted, the apical patch is carmine, with a faint lilac shot rather than crimson. The females vary much in the colouring of the apex in all three species.

The wet-season form is represented by *T. dirus* (=*eboreoides*); *T. immaculatus* is a variety of the same approaching *T. eupompe* in the partial obliteration of the spots on the under surface, although differing in the colouring of the apical patch and sulphur tinting at base of primaries below; *T. dulcis* is a starved wet-season form, *T. alberta* the dry-season form, and *T. subroseus* a starved dry-season form or the dry form of the dwarfed *T. dulcis*.

73. *Teracolus Danae*.

Papilio Danae, Fabricius, Syst. Ent. p. 476 (1775).
Papilio eborea ♀, Cramer, Pap. Exot. iv. pl. cccli. E, F (1782).
Teracolus sanguinalis, Butler, P. Z. S. 1876, p. 158.
Teracolus Taplini, Swinhoe, P. Z. S. 1884, p. 444, pl. xl. figs. 8, 9.

Ranges throughout Wallace's Ceylonese subregion—that is to say, from Bombay to Madras and Ceylon.

This species is in some respects nearer to the African *T. pseudacaste* than to *T. dulcis*, there being no sulphur-yellow at the base of the primaries on the under surface of the males and the carmine apical patch being distinctly broader than in the latter species in both sexes; the heavy continuous black bordering to the secondaries in the wet-season form is characteristic of *T. Danae*, whilst even in the males of the dry-season form it is far more heavy than in the allied species. *T. Danae* is the wet phase, *T. sanguinalis* is intermediate, and *T. Taplini* dry, the last-mentioned having the usual rosy under-surface coloration.

74. *Teracolus fausta*.

Papilio fausta, Olivier, Voy. l'Emp. Oth. Atl. pl. xxxiii. figs. 4 *a*, *b* (1801).
Idmais faustina, Felder, Reise der Nov., Lep. ii. p. 190 (1865).
Teracolus rosaceus, Butler, P. Z. S. 1876, p. 134, pl. vii. fig. 6.
Teracolus oriens, Butler, *t. c.* fig. 7.
Teracolus solaris, Swinhoe (nec Butler), P. Z. S. 1884, p. 437, pl. xxxix. fig. 5.

The range of *T. fausta* appears to be from Syria and the Turko-Persian frontier, through Afghanistan, into North-western India, where it becomes slightly modified and exhibits fairly well-marked seasonal variation. The true *T. fausta*

has a dry-season upperside and the male has a dry-season underside; but the underside of the female exhibits wet-season characters on the lower surface of the wings. The nearest approach to a wet-season form of *T. fausta* is represented by a pair received from Fao, barely distinguishable from the male of my *T. oriens*.

T. solaris of Swinhoe (and formerly of the Museum series), = *T. oriens* (part.), Butler, is the true wet-season form of India, and *T. rosaceus* the dry-season form; but so intimately is this connected with *T. faustina* and *fausta* through the Persian examples above referred to, that it cannot be regarded as a distinct species, but can only be spoken of as the Indian development of *T. fausta*; even as a race it could only be arbitrarily separated by restricting it to Indian examples. On the other hand, Mr. Marshall's action in placing the Arabian *T. vi* as a synonym of *T. fausta* shows want of care, or, perhaps, of discernment, in noting its entirely different wing-outline.

75. *Teracolus vi.*

Teracolus vi, Swinhoe, P. Z. S. 1884, p. 437, pl. xxx. figs. 6, 7.

Aden, Arabia.

This species is allied to *T. fausta*, to which it bears a general resemblance; it, however, differs in its shorter, broader wings, with more arched outer margin, in the much yellower tint of the under surface, from which the discocellular spots have almost wholly disappeared, whereas the discal markings, though soft and blurred, are distinctly discernible both in primaries and secondaries. *T. vi* is undoubtedly a dry-season form which has no other phases, and is as distinct a species from *T. fausta* as are *T. fulvia* and *T. tripunctatus*.

76. *Teracolus fulvia.*

Idmais fulvia, Wallace, Trans. Ent. Soc. 1867, p. 392, pl. ix. fig. 5.
Teracolus solaris, Butler, P. Z. S. 1876, p. 135.
Teracolus Palliseri, Butler, Ann. & Mag. Nat. Hist. ser. 6, vol. i. p. 418 (1888).

Khandesh, S.W. India. The type, in the Museum collection, is said to be from Scinde, but this is probably an error. Mr. Marshall has confounded *T. solaris* with *T. fausta* and *T. fulvia* with *T. tripunctata*; but all are easily separable. *T. solaris* is simply *T. fulvia*, being based upon Wallace's type of that species.

77. *Teracolus tripunctatus.*

♂. *Teracolus tripuncta*, Butler, P. Z. S. 1868, p. 221, pl. xvii. fig. 9.
♀. *Teracolus tripunctatus*, Butler, P. Z. S. 1880, p. 149, pl. xv. fig. 4.
Teracolus surya, Moore, Journ. As. Soc. Beng. lii. p. 45 (1885).

Probably occurs over the greater part of South India and at Trincomali in Ceylon. It is readily separable, both in its wet- and dry-season forms, from *T. fulvia* by the much blacker apical patch on the primaries enclosing three isolated spots of the ground-colour, instead of being divided by a belt of spots; the marginal spotting of the secondaries is also much heavier than in *T. fulvia* and the under surface of the dry-season form yellower and less rosy. We have fifteen examples in the Museum from Bombay and the Nilgiris on the west and from Ganjam and Ceylon on the east.

78. *Teracolus celimene.*

Anthocharis celimene, Lucas, Rev. et Mag. de Zool. p. 426 (1852).
Anthocharis amina, Hewitson, Exot. Butt. iii., *Anth.* pl. i. figs. 1–3 (1866).

Appears to range from Abyssinia to Swaziland, whence we have a dry-season male obtained by Mr. Buxton.

I cannot believe that *Anthopsyche pholoe* of Wallengren is identical with *T. celimene*; the description reads like that of a female, but does not agree with the female in the Hewitson collection. We have the typical wet-season form of male *T. celimene* from Lake Nyasa (G. & S. coll.); therefore Mr. Marshall's suggestion that the western *T. pholoe* is the dry-season form of the eastern *T. celimene* (of which we already have both wet and dry forms) seems far-fetched.

79. *Teracolus pholoe.*

Anthopsyche pholoe, Wallengren, Wien. ent. Mon. iv. p. 35 (1860).
Anthocharis phœnon, Trimen, Trans. Ent. Soc. iii. 1, p. 522 (1863).

The range of this species, so far as at present known, is from Damaraland eastward to Lake Ngami. It seems probable that Wallengren described the female and Trimen the male; the two series of red spots upon which my friend relies as disproving the female character of *T. pholoe* are the chief evidence in its favour, for, as Trimen himself shows, the males of this group of *Teracolus* have the apical patch *purplish lake, violet-glossed* and *intersected* by a black streak, not, as Wallengren says, *black, with violet-glossed red spots in two rows*. The female of *T. præclarus* gives an indication of such a character, but has the marginal spots also red instead of yellow.

80. *Teracolus præclarus.*

Teracolus præclarus, Butler, P. Z. S. 1885, p. 769, pl. xlvii. fig. 7.

Somaliland.

This beautiful species is evidently a link between *T. pholoe* and *T. zoe*, although the latter is in many respects more nearly related to the *T. halimede* group. It is probable that other species of the *T. celimene* type still remain to be discovered. *T. præclarus* appears to be a dry-season form.

81. *Teracolus zoe.*

Anthocharis zoe, Grandidier, Rev. et Mag. de Zool. p. 272 (1867); Mabille, in Grand. Madag. pl. xl. figs. 3–5.

Madagascar.

In the ash-grey base and black veins to the primaries and orange costal stripe to the secondaries this species approaches *T. leo*. In other respects it is nearer to *T. præclarus*.

82. *Teracolus leo.*

Anthocharis leo, Butler, Ann. & Mag. Nat. Hist. ser. 3, vol. xvi. p. 397 (1865).

Appears to be confined to North-eastern Africa, from the White Nile to Somaliland, and southward as far as Kilimanjaro.

It is readily distinguishable from *T. halimede* by the orange patch on the primaries being restricted to below the first median branch and the outer dusky border only represented, even in the wet-season examples, by spots. The type of the species is, in my opinion, an intermediate form between the wet and dry phases. I have not yet seen what I should regard as an undoubted dry-season form, unless it be represented by a small example from Mr. Druce's collection (G. & S. coll.) in which the orange is carried a little above the first median branch, the base somewhat glistening and white, and the apical markings weak as in typical *T. leo*. This specimen is without locality.

83. *Teracolus halimede.*

Pontia halimede, Klug, Symb. Phys., Ins. pl. vii. figs. 12–15 (1829).
Pontia acaste, id. *l. c.* figs. 16, 17 (1829).
Pieris polycaste, Boisduval, Sp. Gén. Lép. i. p. 525 (1836).
Teracolus cœlestis, Swinhoe, P. Z. S. 1884, p. 435, pl. xxxix. figs. 1, 2 (1884).

Confined to Arabia.

T. acaste represents the wet-season phase, *T. halimede* the intermediate, and *T. cœlestis* the dry-season phase of the species; but they are none of them confined to seasons, but occur (as is the case with other species in very arid countries) as mere coexistent variations. If the species could be transferred to a variable climate, doubtless the varieties would become strictly seasonal forms, as is the case with other species of *Teracolus*. Our series of this species is very fine.

84. *Teracolus venosus*.

♂. *Idmais venosa*, Staudinger, Exot. Schmett. p. 43, pl. xxiii. (1885); ♀, Holland, Proc. U.S. Nat. Mus. vol. xviii. p. 759 (1896).

Mombasa.

This is a wet-season form somewhat resembling *T. acaste*, but entirely without the orange flush on the upper surface of the wings. It would not surprise me to find that in the dry season the male had a tint of orange and that the female resembled a washed-out *T. cœlestis*. However, this is mere conjecture. Mr. Marshall says that *T. venosus* comes closest to the *halimede* group. I would go a step further and say that it belongs to that group, for it differs in nothing but the absence of orange colouring.

85. *Teracolus heliocaustus*.

Teracolus heliocaustus, Butler, P. Z. S. 1885, p. 768, pl. xlvii. figs. 8, 9.

Somaliland.

Intermediate between *T. halimede* and *T. pleione*, being a little nearer to the latter, which it represents on the Somali coast. It is a dry-season form, varying much in the black markings of the upper surface.

86. *Teracolus pleione*.

Pontia pleione, Klug, Symb. Phys., Ins. pl. viii. figs. 7, 8 (1829).
Idmais miriam, Felder, Reise der Nov., Lep. ii. p. 190, pl. xxvii. figs. 3, 4 (1865).
Teracolus chrysomelis, Butler, Cist. Ent. i. p. 244 (1874).
Idmais eucheria, Mabille, Bull. Soc. Ent. Fr. (5) ix. p. clxxiv (1879); Grand. Madag. pl. xi. fig. 5 (1887).

White Nile and Arabia.

T. miriam (=*chrysomelis*) is the dry-season phase of *T. pleione*; but in Arabia both forms occur as mere varieties simultaneously and emerge on the same day from the same batch of pupæ. It would be interesting to know whether the forms are seasonally constant on the White Nile.

87. *Teracolus gaudens.*

Teracolus gaudens, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 486 (1876).

Abyssinia.

The type is a wet-season male, and for some time I held Mr. Marshall's opinion, that *T. arenicolens* from Arabia was clearly its dry-season form. This, however, I have now proved to be an error, based upon a false identification of *T. chrysonome*—an Arabian species and distinct from the Somali insect.

88. *Teracolus chrysonome.*

Pontia chrysonome, Klug, Symb. Phys., Ins. pl. vii. figs. 9–11 (1829).
Teracolus arenicolens, Butler, Ent. Month. Mag. xxi. p. 81 (1884).

Arabia and Nubia.

In the Godman and Salvin collection were four examples of typical *T. chrysonome* (received from Mr. Druce, who purchased them from the Kaden collection); these correspond closely with Klug's figures, and are undoubtedly the wet-season form of *T. arenicolens*. They differ from my supposed *T. chrysonome* from Somaliland in the much less defined markings upon an opaque pale sulphur ground on the under surface, and on the upper surface in the slightly more slender and sometimes imperfect blackish irregular stripe across the primaries; the males also with the basal white area chalky, much less suffused with ash-grey, and extending to the end of the discoidal cell.

89. *Teracolus helvolus.*

Teracolus chrysonome, Butler (not Klug), P. Z. S. 1885, p. 768.
Teracolus helvolus, Butler, P. Z. S. 1888, p. 94.

Somaliland southward to Mombasa and Kilima-njaro.

T. helvolus is the dry-season phase of the species; but it is doubtful whether it does not appear simultaneously with the wet-season phase. Our Somali specimens, however, were not taken together, the dry form having occurred in January and the wet form in April.

90. *Teracolus aurigineus.*

Teracolus aurigineus, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 103 (1883).
Teracolus venustus, Butler, P. Z. S. 1888, p. 94.

From the Albert Nyanza eastwards to Mount Kenia, the Victoria Nyanza, and Kilima-njaro, and southwards to Nyasa.

We have a very fine series of wet-, intermediate, and dry-season examples of this species. *T. aurigineus* represents the wet and *T. venustus* the dry phase.

Race? *Teracolus Ansorgei.*

Teracolus Ansorgei, Marshall, P. Z. S. 1897, p. 13.

Somaliland.

Chiefly differs from *T. aurigineus* in the absence of the ashy whitish base to the primaries of the male; but, if examples from Gallaland are referable to the same species, this character must be variable.

91. *Teracolus Doubledayi.*

Idmais Doubledayi, Hopffer, Peters's Reise n. Mossamb., Zool. v. p. 363 (1862).
Idmais Hewitsoni, Kirby, Cat. Diurn. Lep. p. 498 (1871).
Idmais chrysonome, Doubleday and Hewitson (not Klug), Gen. Diurn. Lep. pl. vii. fig. 5 (1847).

Congo, Angola.

The dry-season form is small and suffused with vinous over the darker markings of the under surface, the bands across the secondaries being vinous brown instead of golden orange or cadmium-yellow.

92. *Teracolus rhodesinus.*

Teracolus rhodesinus, Butler, P. Z. S. 1893, p. 663.

Lake Mweru, Central Africa

I have only seen the type of this species (a wet-season male), but it is so markedly distinct from the allied *T. mutans* that I cannot for a moment entertain the notion of its being a form of that species. It differs not only in the slender discal band across the upper surface (which is partly obliterated), but in the creamy ochreous tint of the upper surface extending inwards almost to the base of the secondaries, in the paler sulphur tint of the apex of primaries and the secondaries on the under surface, as also in the strongly defined and more parallel inner angular band across the latter wings. In some of these characters it more nearly approaches *T. aurigineus.*

Mr. Marshall asserts that this butterfly combines the characters of *T. Hanningtoni* and *mutans*! I fail to see where *T. Hanningtoni* comes in.

93. *Teracolus mutans.*

Teracolus vesta, Trimen (not Reiche), South Afr. Butt. vol. iii. p. 160 (1889).
Teracolus mutans, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 459 (1877).
Teracolus argillaceus, Butler, *ibid.* (and *T. vesta*, Staudinger, Exot. Schmett. i. pl. xxiii., 1884).

Ranges from Nyasa southwards to Natal, occurring on the Zambesi, in the Transvaal, and at Delagoa Bay.

After examining twenty-nine examples of this species, including some interesting varieties recently collected by Mr. Guy A. K. Marshall, I am unable to follow that gentleman in his decision as to the identity of the southern insect with the Abyssinian *T. vesta*; the latter, judging from the descriptions and the original illustration, is slightly larger and differs in the salmon-buff of the upper surface extending in the cell of primaries right up to the almost black basal suffusion, in the even heavier black border of the secondaries and the yellow suffusion on the interno-median area, in the less irregular and uniformly redder bands on the under surface of the secondaries, the inner and submarginal bands being also broadly and sharply defined. Most examples of *T. mutans* show very little blackish suffusion at the base of the wings on the upper surface; but Mr. Marshall, who seems to be one of the most energetic and indefatigable of collectors, has sent us several unusually heavily shaded examples, in which the basal suffusion is deep bluish ash-coloured, but far from approaching the grey-blackish tint of typical *T. vesta*. The more southern examples of *T. mutans* are considerably smaller than the Abyssinian species, but the Nyasa examples sometimes run it very close in expanse of wings.

T. argillaceus is the dry-season form of the species, and we have some very pretty intermediate examples from Delagoa Bay and Nyasa.

94. *Teracolus vesta.*

Idmais vesta, Reiche, in Ferr. Gal. Voy. Abyss., Ent. p. 463, pl. xxxi. figs. 7, 8 (1849).
Idmais velleda, Lucas, Rev. et Mag. de Zool. 1852, p. 428.

Abyssinia.

Both descriptions and the illustration of this species are taken from the wet-season form. Reiche's figures apparently represent a female. It is probable that the male will prove to be less black at the base of the wings above.

95. *Teracolus catachrysops.*

Teracolus catachrysops, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 178 (1878).

East Africa, from the Sabaki valley southwards to Masasi.

The wet form alone of this species has hitherto been received. It is readily separable from *T. mutans* and *vesta* in the small size of the submarginal spots on the black external area, and in the white colour of these spots on the secondaries of the female; from *T. mutans* also in the greater distinction of tint between the orange ground-colour and yellow apical and external spots on the under surface of the primaries and the deep red bands on the under surface of the secondaries, and from *T. vesta* in the straighter character of these bands and the slenderness of the innermost one.

A female from the Sabaki valley has the ground-colour above entirely white, feebly tinted with sulphur-yellow, and the colouring below paler than usual.

96. *Teracolus Hanningtoni.*

♂ ♀. *Teracolus Hanningtoni*, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 104 (1883).

♀. *Teracolus bipartitus*, Rothschild, Novit. Zool. i. p. 537 (1894).

From the Victoria Nyanza eastward to Witu.

This species may be distinguished at a glance from its nearest ally *T. catachrysops* by the minute discocellular spot on the primaries, the more tapering series of spots on the black external area of the secondaries, the minute subapical spots on the primaries, the yellower discal colouring on the under surface of these wings, and the dark veining of the same surface of the secondaries. Mr. Marshall states that Mr. Jackson's series shows the impossibility of separating these two species; but I have often been told similar things about other butterflies, and am not inclined to accept any such observation on trust, especially from a man who, though a good observer, sees no difference between the illustration of *T. vesta* and *T. mutans*, but speaks of both as "typical specimens" *.

97. *Teracolus amelia.*

Idmais amelia, Lucas, Rev. et Mag. de Zool. 1852, p. 428.

Abyssinia.

Although more nearly related to *T. Hanningtoni* than to

* I have recently examined Mr. Jackson's series, and had no difficulty whatever in assigning them to their proper species.

any other species of the group, this butterfly differs from all in the much greater restriction of the ochreous colouring on the primaries of the male (which commences beyond the end of the cell), in the entirely different coloration of the under surface, the primaries being saffron-yellow on basal two fifths, very pale creamy yellow on the disk, and with the dark bands golden olive or yellow-brown, the two outer bands on the secondaries near together and arched rather than angulated (as in *T. vesta* as compared with *T. mutans*). From all the species excepting *T. Hanningtoni* it differs in the minute discocellular spot on the primaries. Only the wet-season form is known at present either of *T. Hanningtoni* or of this species.

98. *Teracolus protomedia.*

Pontia protomedia, Klug, Symb. Phys., Ins. pl. viii. figs. 13, 14 (1829).

Ranges from the Albert Nyanza northward to Abyssinia and eastward through Somaliland to Arabia.

It is closely related to the preceding species and especially to *T. Hanningtoni*, but its superior size, bright uniform yellow colouring, black-veined primaries, less banded upper surface of secondaries, and lack of a subbasal band on the under surface of these wings, have saved its being regarded as a variety of *T. vesta*. These differences, though perhaps not greater than exist between *T. amelia* and *T. mutans*, are more readily grasped without effort.

The seasonal differences are well defined, the wet-season phase having the chief markings below smoky brown, partly veined with saffron-yellow; the intermediate form has these markings redder and with well-defined veining; the dry phase has them almost wholly bright reddish orange. At Aden all three types occur together as mere variations.

LIX.—*On the Tetrameric Regeneration of the Tarsus in* Phasmidæ. By Edmond Bordage*.

At the meeting held on January 25 last I had the honour to communicate to the Académie des Sciences a few of the principal results that I had obtained previously with reference to the phenomena of autotomy in Phasmidæ†. In conclusion I spoke of the process of regeneration of the ampu-

* From the 'Comptes Rendus,' t. cxxiv. no. 26 (June 28, 1897), pp. 1536–1538: from a separate impression communicated by the Author.

† *Vide suprà*, pp. 473, 476.

tated limbs in the larvæ and nymphs, and I stated that *very frequently* the regenerated limbs exhibited only four joints in their tarsi.

I should say that at that time I had been able to make but a limited number of experiments, and that I did not imagine that I had to deal with a general rule. Since then I have multiplied my observations, and I have clearly proved that the expression "*very frequently*" ought to be replaced by *always*. I must also make mention of the curious circumstance that, in the first place, was especially instrumental in causing me to doubt the generality of this rule.

In the collections of the Natural History Museum of the Island of Réunion (an establishment of which I am director) I had noticed a female *Monandroptera* of which the second pair of legs appeared themselves to be of equal length, although relatively shorter than the others. Moreover, the tarsus of one of them possessed five joints, while that of the other exhibited only four. My first idea was that in the case of these two limbs regeneration had taken place after autotomy. This seemed then to imply that this regeneration produced sometimes five tarsal joints and sometimes four.

But measurements taken with the greatest care enabled me to ascertain that the limb with the pentamerous tarsus was of perfectly normal length, though it was owing to the length that, at the outset, I had been led to doubt the position given to the second pair of legs by the person by whom the insect had been set. While the anterior legs were stretched straight out in the direction of the axis of the body and the posterior ones were extended at right angles thereto, those of the second pair, quite doubled up, took the form of a V reversed; and it was just this shortening that had made me believe that the dimensions were smaller. If the limb with the pentamerous tarsus was of normal length, that with the tetramerous tarsus, which seemed to be equal to it, was nevertheless shorter by nearly 4 millim. I was therefore led to conclude that the latter was the only one that formerly had undergone autotomy.

To explain so trifling a difference in the length of the two limbs and the absolutely similar coloration that they exhibited one had necessarily to suppose that spontaneous amputation had taken place when the insect was still but a larva scarcely emerged from the egg.

In order to assure myself of the fact I collected a certain number of eggs of *Monandroptera inuncans* and watched them hatch. At birth the larvæ measure about 1 centim. in length by 1 millim. in breadth. Their colour is a pale yellow,

with rust-coloured bands forming equidistant rings round the body and legs. The latter have a mean length of 8 millim. One would therefore at first be tempted to suppose that the smallest difference in length between two limbs of the same pair—the one normal, the other regenerated after autotomy—could not be less than this number of millimetres. Under these conditions how are we to suppose that a limb has been regenerated after autotomy, because its length is less by scarcely 3 or 4 millimetres than that of the corresponding limb? I succeeded nevertheless in assuring myself by experiment that the thing was possible. In order to do this I provoked autotomy in a larva which had just hatched. The amputated leg measured 8 millim. and was of precisely the same length as the limb opposite to it. *A priori* one might therefore suppose that the regenerated limb would always be shorter by at least 8 millim. than the one which had remained intact. However, immediately after the first moult, when the larva had just quitted its skin, I perceived the regenerated limb forming a little spiral, which unrolled itself after a few days and assumed the appearance of the other legs. The length of this regenerated limb was between 7 and 8 millim., so that the limb opposite to it, having increased by only 3 millim. and then having a length of 11 millim., the difference between the two legs was little more than 3 millim. There is therefore a difference between the rate of growth of the normal limb and the rate of growth of the limb in course of regeneration, this latter growing more rapidly. This phenomenon certainly affords the interpretation of the doubtful case that I mentioned at the beginning of this communication.

The question may arise whether the variation in the number of the joints of the tarsus is always a consequence of amputation by autotomy or whether it is sometimes congenital. Although hitherto I have never seen tetramerous tarsi in larvæ of Phasmidæ examined immediately after birth, *tetramery* might nevertheless very well be observed in the young on emerging from the egg, and consequently without having been preceded by the slightest mutilation.

So far from regarding autotomy as a *relatively* recent improvement, I should, on the contrary, be disposed to believe that in primary ages certain groups of insects already benefited by the advantages of this protective process. If, indeed, we examine carefully certain of the drawings given by M. Ch. Brongniart in his handsome memoir on primary insects ('Recherches pour servir à l'histoire des Insectes fossiles des temps primaires,' 1893), and especially the figures of pl. xlix. and fig. 1 of pl. xxxvii., we notice in the limbs an arrange-

ment of the coxa, trochanter, and femur strongly suggestive of that pointed out by me in the case of the Phasmidæ in my communication to the Académie des Sciences of February 15, 1897 *. I was particularly struck with this on examining the last figure referred to, which, however, represents an insect much more nearly allied to the Neuroptera than to the Orthoptera, since M. Ch. Brongniart has assigned it to the former.

Messrs. Bateson and Brindley, after mentioning numerous instances of *tetramery* in Blattidæ, conclude that they are to be regarded as cases of *abrupt variation* ("*variation brusque*"), explaining up to a certain point how a species with tetramerous tarsi might be derived, abruptly so to speak, from a species with pentamerous tarsi ('Materials for the Study of Variation,' 1894, pp. 63 and 415–421). A philosophical explanation appears to me much more logical: this consists in regarding, on the contrary, these interesting facts as cases of *atavism*, of reversion to an ancestral condition similar to that still to be observed in the Locustidæ †.

LX.—*New Insects from Embudo, New Mexico.* By T. D. A. Cockerell, Entomologist of the New Mexico Agricultural Experiment Station.

As we ascend the Rio Grande the fauna and flora gradually change, southern types giving place to others of a boreal or sub-boreal character. The detailed study of the distribution of species up and down the banks of the river presents much to attract the zoologist or botanist, and the briefest investigations are repaid by new and interesting results. The present writer had recently an opportunity of spending a couple of days at Embudo, situated on the Rio Grande in northern New Mexico, about 300 miles north of Mesilla. This locality is in a district never explored by entomologists, and it was to be expected that new forms would be found. These expectations were not disappointed, and descriptions of the novelties are herewith presented.

Apidæ.

At the flowers of *Bigelovia* four species of *Perdita* occurred, three of them in considerable numbers. They were as follows:—

* *Vide suprà*, p. 476: "Phenomena of Autotomy in Phasmidæ belonging to the Genera *Monandroptera* and *Rhaphiderus*."

† *Cf.* A. Giard, 'Comptes Rendus de la Société de Biologie,' 1897, no. 12, p. 315.

(1) *Perdita Townsendi*, Ckll.

Both sexes, Sept. 25 and 26. Known before only from the White Sands.

(2) *Perdita affinis*, Cress.

Known before only from Colorado. Many taken, Sept. 26.

(3) *Perdita rhodura*, sp. n.

♀.—Length hardly 6 millim.

Head and thorax dark olive-green, moderately hairy, face not hairy; abdomen banded. Head ordinary, front strongly granular; antennæ dark brown, stripe on scape and flagellum beneath dull yellowish or ochraceous; labrum, mandibles (except tips), and face-marks white; sides of clypeus with large shallow punctures; lower half of clypeus white, the white extending upwards in three tooth-like projections, the lateral ones having the clypeal dots at their base; the upper outline of the white on the clypeus is that of a **W**; lateral face-marks broad below, gradually tapering to a blunt point opposite the upper edges of the antennal sockets. Tubercles white at ends; mesothorax granular and sparsely punctured; tegulæ hyaline, with a dull white spot; wings hyaline, iridescent; nervures dark brown, stigma hyaline except margin, poststigmatal portion of marginal cell a little longer than substigmatal, second submarginal large, narrowed more than half to marginal, third discoidal distinct. Legs black; trochanters, knees, anterior and middle tibiæ in front, and anterior tarsi light yellow or yellowish white. Abdomen above with segments 1 to 3 white, 4 and 5 brownish orange; segments 1 to 3 with piceous bands at base and hind margin, 4 with similar but more suffused banding. Venter dull yellowish, becoming orange at apex.

♂.—Length 5 millim.

Antennæ bright lemon-yellow, funicle and flagellum (except last two segments) largely piceous above; face all bright lemon-yellow up to the level of the length of the scape above insertion of antennæ, the yellow including the anteorbital black spots; labrum and mandibles (except extreme tips) lemon-yellow; prothorax (except two spots anteriorly and quadrate patch on pleura) yellow; legs yellow, hind tibiæ behind and hind tarsi piceous; abdomen with the first segment piceous at base, but no well-defined bands, only suffused ones along hind margins of 1 and 2.

Hab. Embudo, Sept. 25. Many specimens.

P. rhodura ♀ runs in my table of *Perdita* (Proc. Phil. Acad. 1896) to 71, and is separated from *P. Snowii* by the pallid venter, marking of clypeus, &c. It most resembles *P. crotonis*, especially in the colour of the abdomen, but differs at once by the face-markings, granular mesothorax, &c. *P. rhodura* ♂ runs in the table to 12, but is quite distinct from *P. chamæsarachæ*, to which it comes nearest.

(4) *Perdita subfasciata*, sp. n.

♀.—Length about 5 millim.

Thorax small; head and thorax very dark bluish green, almost black; front microscopically tessellate and sparsely punctured; face wholly dark; clypeus black, with strong sparse punctures, wanting in the middle; labrum and mandibles wholly dark; antennæ piceous, flagellum light brown beneath. Prothorax and tubercles wholly dark; mesothorax microscopically tessellate and sparsely punctured, median and parapsidal grooves distinct; tegulæ hyaline, with a white spot at anterior base. Wings hyaline; nervures colourless, except the subcostal, margins of stigma, and of marginal cell, which are brown; marginal cell with substigmatal portion noticeably longer than poststigmatal; second submarginal narrowed scarcely half to marginal; third discoidal present. Legs black, first four tarsi, anterior tibiæ in front, and anterior knees dull yellow. Abdomen above brown-black, segments 3 to 5 each with a broad, straight, subbasal band of dull yellow, abruptly terminating some distance before the lateral margin. Venter piceous.

Hab. Embudo, Sept. 25. One.

P. subfasciata runs in my table of *Perdita* (*l. c.*) to 19, but is quite different from *P. mentzeliæ*. It is not unlike *P. æneifrons*, but differs at once by the bands on the abdomen &c.

The only other *Perdita* taken at Embudo was *P. zebrata*, Cress., one at flowers of *Cleome serrulata*, Sept. 26.

Andrenidæ.

Andrena vulpicolor, sp. n.

♀.—Length about 15 millim.

Black, with fox-red pubescence. Head of ordinary form; antennæ black; face rather thinly clothed with orange hair; cheeks densely clothed with orange and occiput with bright rufous hair. Process of labrum truncate, very large and broad; clypeus granular and with large punctures; sides of

face smoother and more shiny, but still granular, with rather sparse punctures; front roughened. Pubescence of thorax dense, orange beneath, fox-red above; a large part of mesothorax and middle of scutellum practically nude, as also the metathoracic enclosure, which is dull and not bounded by any raised line. Mesothorax regularly and strongly granular; scutellum granular, with shallow punctures. Tegulæ transparent amber-colour. Anterior wings rather pale fuliginous, broadly darker on outer margin, largely hyaline in median and anal cells; nervures and stigma piceous, stigma rather small; hind wings hyaline, with the basal third fuliginous. Legs black, with orange hairs. Abdomen black, microscopically tessellate, with very sparse inconspicuous shallow punctures; sides of first segment, broad submarginal bands on segments 2 to 4 (on 2 interrupted medially), the fifth segment, and the apex all clothed with foxy-red hair; in addition, the second and third segments have very narrow apical hair-bands, contrasting with the rufous broad hair-bands above them. Tibial spurs rufous.

Hab. Embudo, at flowers of *Bigelovia*, Sept. 25 to 27. Nine specimens.

This fine species seems to be allied to *A. obscuripennis*, Smith, from Georgia, but it differs from that in the entirely black clypeus, the colour of the legs, and the distinct fasciæ of the abdomen.

Mutillidæ.

Ephuta californica (Rad.), var. *euchroa*, n. var.

♀.—Similar to the typical form, but the bright pubescence (on dorsal surfaces of head, thorax, and abdomen) all of a beautiful deep crimson or carmine, instead of ferruginous or golden ochraceous.

Hab. Embudo, one on sand by the river, Sept. 25. Also one collected by Prof. H. F. Wickham at Coolidge, N. M., some years ago.

I have seen exactly the same colour of pubescence in an example of *Ephuta pacifica* (Cresson), collected by Mr. Wickham in California. This insect bears a great resemblance to our variety, but is readily distinguished by its considerably larger head.

The generic name *Ephuta* has priority over *Sphærophthalma*, as has been indicated by Mr. Fox.

Coccidæ.

Eriococcus arenosus, sp. n.

♀.—Scale oval, about 4 millim. long, white, covered all over with particles of sand.

♀.—Boiled in caustic soda stains the liquid reddish. Legs and antennæ pale brownish; antennæ shorter than tibia+tarsus, 7-segmented, 4 longest, 3 a little shorter than 1, then 2, then 5. Formula 4 3 1 2 5 (6 7). 4 about as long as 5+6+7; 7 quite bristly. Legs large; coxa large; femur hardly a third longer than tibia; tibia and tarsus almost exactly the same length, each with a few stout bristles. Claw large, not much curved; all the digitules filiform, with inconspicuous knobs, that of tarsus extending nearly as far as those of claw. There appears to be only one tarsal digitule. Skin with many round gland-spots and stout blunt spines. Caudal tubercles elongate. ♀ flattened under cover-glass $3\frac{1}{3}$ millim. long, oval.

Eggs pale lemon-yellow.

♂.—Scale small and narrow, yellowish white or snow-white, not covered with sand.

Hab. Embudo, Sept. 26, on a low herbaceous plant with linear conspicuously gland-dotted leaves, not seen in flower*.

The sand-covered sac is a peculiarity of the Coccid.

Lecaniodiaspis artemisiæ, sp. n.

♀.—Scale suboval, 3 millim. long, $1\frac{2}{3}$ wide, reddish ochreous, peppered with black specks; surface dull, rough and tuberculate, thoracic region with two prominent transverse crests.

♀.—Dermis with scattered figure-of-8 glands and small spines. Caudal tubercles quite well developed. Mentum rather obscurely trimerous. Antennæ apparently absent in adult; in younger examples they are small rounded prominences, bristly at end, without visible joints. The insects after boiling are pale pinkish.

♂.—Scale about $1\frac{1}{3}$ millim. long, subcylindrical, cream-colour with black specks. The black specks on the scales consist of extraneous matter attached.

Hab. Embudo, Sept. 25, on sage-brush (*Artemisia*). A bright red mite occurs among them.

L. artemisiæ is very distinct by the aborted antennæ.

* I sent the plant on which *Eriococcus arenosus* was found to Prof. E. O. Wooton, who says he thinks it is safe to call it *Psoralea micrantha*, Gray.

The other Coccids found at Embudo were *Coccus confusus*, Ckll. (between Embudo and Rinconada), *Dactylopius gutierezia*, Ckll. (also at Rinconada), *D. lichtensioides*, Ckll. (empty sacs only), *Orthezia artemisiæ*, Ckll. ined., and *O. nigrocincta*, Ckll.

LXI.—*Descriptions of further new Species of Butterflies from the Pacific Islands.* By H. Grose-Smith, B.A., F.E.S., F.Z.S.

Limenitis chilo.

Female.—Upperside. Anterior wings chocolate-brown; the disk is crossed beyond the cell by an oblique band of contiguous white spots, divided by the brown veins, and extending from near the costal margin, a little beyond its middle, to near the lowest submedian nervule at one third from the outer margin; a subapical tawny patch and a submarginal narrow sinuate band. Posterior wings with the basal half chocolate-brown and the outer half pale tawny brown, with a rather broad brown outer margin and a submarginal sinuate brown line from the apex to the anal angle.

Underside. Anterior wings with a reniform pale grey bar crossing the cell about its middle and a white streak at the end of the cell, both margined with red-brown, and two reddish-brown spots below the cell towards the base, the lower smaller than the upper spot; the oblique white discal band extends nearer to the margin and outer angle than on the upperside. Posterior wings with a subovate red-brown ring towards the base below the costal nervure, and several red-brown markings in the cell; two red-brown bars cross the wings, one before, the other beyond the middle; the outer tawny space of the upperside is represented by a pale pinkish-brown area, the submarginal brown line, as on the upperside, edged externally by whitish brown.

Exp. of wings $1\frac{7}{8}$ inch.

Hab. Sumba, below 2000 feet (*Doherty*).

In the collection of the Hon. Walter Rothschild. A single specimen only, in a battered condition.

Hypocista calypso.

Male.—Upperside. Differs from *H. osyris*, Boisd., in the more restricted area of the pale tawny patch on the posterior wings, which is confined to the outer two thirds of the cell

and a space above the subcostal nervure not quite reaching the costal margin. In *H. osyris*, *H. isis*, Stgr., and *H. serapis*, Stgr., this pale space is white and extends beyond the cell to the inner margin.

On the *underside* the pale transverse band below the cell of the anterior wings to the middle of the inner margin is narrower than in *H. osyris*, and on the posterior wings the discal ocelli are smaller and the fulvous rings surrounding them are more dusky.

The *female* differs from the same sex of *H. osyris* in similar respects.

Exp. of wings $1\frac{1}{4}$ inch.

Hab. Samarai (*Woodford*) and Tupulamu, British New Guinea.

Described from a pair from the former place and two males from the latter place.

In Mr. Grose-Smith's collection.

Thysonotis lygia.

Male.—Upperside. Both wings dull blue: anterior wings with the costal and outer margins narrowly greyish black; a patch of white scales in the central area below the cell at the junction of the submedian nervules with the median nervure. Posterior wings with the outer two thirds of the costal margin to the apex broadly white, and a broad greyish-black outer margin, becoming wider towards the anal angle.

Underside. Anterior wings white, with a broad black band on the costal and apical margins, which extends over the upper third of the cell and becomes wider towards the apex, thence narrowing along the outer margin to the outer angle. Posterior wings closely resemble those of *T. phroso*, Grose-Smith, but the subbasal black band is narrower and the white band outside it extends further along the costal margin to the apex; the black spots in the submarginal blue band are less elongate; cilia of both wings black.

Female.—Upperside scarcely differs from *T. phroso*, but on the posterior wings the costal white area is wider.

Underside also closely resembles *T. phroso*, but on the posterior wings the subbasal black band is narrower and the basal blue area is more extended.

Exp. of wings, ♂ $1\frac{1}{4}$, ♀ $1\frac{3}{8}$ inch.

Hab. Samarai, Dinner Island (*Woodford*).

In Mr. Grose-Smith's collection.

Thysonotis hengis.

Male.—Upperside resembles *T. Wallacei*, Feld., but the wings are brighter blue and the central irroration of white scales on the anterior wings is less conspicuous; on the posterior wings the white band before the middle is narrower.

Underside differs little from *T. Wallacei*, but on the anterior wings the costal and apical black area is narrower, as well as the white band on the posterior wings.

Female.—Upperside. Both wings darker brown than in *T. Wallacei*, being nearly black: on the anterior wings the dark costal band is bounded at the base by the median nervure, while in *T. Wallacei* it extends at the base broadly to the inner margin. On the posterior wings the white subbasal area is considerably less extended.

On the *underside* of the posterior wings the subbasal white band is narrower, the outer black area being broader; the submarginal blue band is wider and the black spots in it are more elongate; the cilia on both wings are less conspicuously white.

Exp. of wings 1⅝ inch.

Hab. Kapaur, S.W. Dutch New Guinea (*Doherty*).

In the collections of the Hon. Walter Rothschild and Mr. Grose-Smith (types).

Described from a long series of both sexes.

It is a considerably larger insect than *T. Wallacei*, and the wings are broader and rounder. The female resembles *T. vidua*, Grose-Smith, but the white spot at the outer angle, and the subcostal blue streak on the upperside of the anterior wings of that species are absent, and the white area on the posterior wings is less extended and less sharply defined than in *T. vidua*.

Holochila æqualis.

Male.—Upperside. Both wings resemble *H. refusa*, Grose-Smith, but blacker brown. On the anterior wings the white area is more extended over the cell and beyond it, and the blue suffusion at the base of both wings of *H. refusa* is very slightly represented by dull slate-coloured scales which are less extended than in *H. refusa*.

Underside. The outer dark brown marginal bands of both wings are twice as broad as in *H. refusa*.

Female.—Upperside resembles the male, but is browner and without any bluish suffusion.

On the *underside* the outer dark brown marginal bands of both wings are likewise twice as broad as in *H. refusa*.

Exp. of wings, ♂ 1, ♀ 1⅛ inch.

Hab. Kapaur (*Doherty*).

In the collections of the Hon. Walter Rothschild and H. Grose-Smith.

A long series is in the collection.

Nacaduba narovona.

Male.—Upperside dull slate-coloured blue, with the white bands on the underside slightly visible.

Underside greyish brown. Anterior wings with a spot at the end of the cell bordered on both sides with white, and a broad somewhat curved transverse band of contiguous spots across the disk, bordered on the inner edge with white, followed externally by a broad white band, outside which to the margin is a double row of dark lunules, intersected by a row of white lunules. Posterior wings with a similar white band and outer rows of lunules; between the two lowest submedian nervules is a large submarginal black spot, bordered outwardly by metallic blue and crowned by an orange lunule; a smaller metallic blue spot at the anal angle also crowned by orange and bordered narrowly by black; a subbasal row of spots crosses the cell, and a spot at the end of the cell, all narrowly bordered by white.

Female.—Upperside. Both wings dull greyish brown, suffused with dull blue over the lower part of the anterior and the base of the posterior wings. On the anterior wings a pale whitish band crossing the submedian nervules represents the white band on the underside, and on the posterior wings a similar indistinct band crosses the disk a little beyond the middle; there is a submarginal row of dark lunules crowned with whitish lunules.

Exp. of wings 1 inch.

Hab. Narovo, Solomon Islands (*Woodford*).

In the collection of Mr. Grose-Smith.

This species is readily distinguished by the conspicuous white bands on the underside of both wings. It is nearest to *N. ligamenta*, H. H. Druce.

LXII.—*On a Collection of Land and Freshwater Shells from Rotuma Island.* By Edgar A. Smith.

In April 1896 the British Museum received from Mr. R. B. Leefe, H.M. Vice-Consul at the Tonga Islands, a series of land and freshwater shells which he collected during a visit to Rotuma. The collection contained one species of *Partula*, an *Opeas*, one *Helicina*, an *Omphalotropis*, and a *Melania*.

Mr. J. Stanley Gardiner has kindly placed in my hands for examination the specimens which he obtained in this island, and which he believes to be a "tolerably complete collection." In addition to the species found by Mr. Leefe, his series includes one *Rhytida*, two species of *Charopa*, a *Ternatellina*, a *Succinea*, and a second species of *Helicina*. Besides these land-shells, Mr. Gardiner also collected some Auriculidæ and Littorinidæ, some of which were obtained over a hundred feet above the sea. He paid "a good deal of attention to collecting these, searching the tops of several of the hills as well as the valleys," and he thinks "the collection, though small, is fairly representative. There is no indigenous forest left anywhere on the island."

Rotuma, or Rotumah, is situated about 300 miles N.N.W. of Fiji. As no Mollusca have hitherto been recorded from this locality, the following list may have some interest.

The land Mollusca are similar in general characters to those occurring in the nearest groups of islands; and out of the ten species six appear to be peculiar to the island. Some of these being obscure forms and difficult of determination may, however, eventually prove to be slight variations of already known species.

None of the Auriculidæ and Littorinidæ, which usually have a more extended range than terrestrial Pulmonates and Operculates, are restricted to Rotuma.

List of the Species.

Family Testacellidæ.

1. *Rhytida Gardineri.*

Testa orbicularis, late umbilicata, albida, rufo flammulata, periostraco tenui olivaceo induta, lineis incrementi subrugosis curvatis obliquis striisque spiralibus paucis supra et infra sculpta; spira depressa, in medio impressa; anfractus quatuor, convexiusculi, celeriter accrescentes, sutura profunda sejuncti, ultimus supra oblique depressus, ad peripheriam obtusissime subangulatus

antice haud descendens; apertura parva, leviter obliqua, late lunata: peristoma tenue vel subincrassatum, marginibus callo tenui junctis, columellari haud reflexo.
Diam. maj. 7 millim., min. 6; alt. $2\frac{3}{4}$.

Allied to *R. rapida*, Pfeiffer.

Family **Helicidæ**.

2. *Charopa Perryi*.

Testa orbicularis, latissime umbilicata, alba, epidermide olivacea induta, lineis incrementi elevatis curvatis tenuibus instructa; spira depressa, supra anfr. ultimum paulo elata; anfractus quatuor, convexi, primus lævis, pellucidus, ultimus supra leviter declivis, antice subdescendens; apertura obliqua, irregulariter rotundata, intus alba; peristoma tenue, marginibus conniventibus, callo tenui albo junctis, columellari ad insertionem vix expanso.
Diam. maj. $3\frac{1}{2}$ millim., min. 3; alt. 2.

Hab. Mota Island, New Hebrides (*Brit. Mus.*); Rotuma (*Gardiner*).

Remarkable for the very wide umbilicus, the absence of colour-markings, and the white porcellanous aperture. The riblets are fine and not so regular in appearance as in many other species in this genus. Named after Mr. W. W. Perry, who collected the species at Mota Island.

3. *Charopa rotumana*.

Testa parva, orbicularis, profunde mediocriter umbilicata, pallida, radiis obliquis curvatis rufis conspicue picta, lineis incrementi liriformibus tenuibus obliquis curvatis instructa, inter liras microscopice spiraliter striata; spira depressa, supra anfr. ultimum minime elata; anfractus $4\frac{1}{2}$, lente accrescentes, convexi, sutura profunda sejuncti, apicales $1\frac{1}{2}$ haud lirati, ultimus ad peripheriam rotundatus, haud descendens; apertura oblique lunata; peristoma tenue, simplex, margine columellari ad insertionem vix reflexo.
Diam. maj. $2\frac{3}{4}$ millim., min. $2\frac{1}{2}$; alt. $1\frac{1}{3}$.

In form very like *Endodonta consimilis*, Pease, from Tahiti, but smaller, more finely sculptured, and without a parietal lamella.

Family **Bulimulidæ**.

4. *Partula Leefei*.

Testa dextrorsa, parva, ovata, umbilicata, flavo-olivacea, infra suturam et versus apicem pallida; spira mediocriter producta,

ad apicem rotundata, obtusa; anfractus 5, convexiusculi, lineis incrementi tenuibus, striisque spiralibus tenuissimis (in anfr. ult. plus minus obsoletis) confertis sculpti, ultimus antice haud descendens; apertura ovata, intus fuscescens, longit. totius $\frac{1}{2}$ subæquans; peristoma album expansum et reflexum, vix incrassatum.

Longit. 14 millim., diam. 9; apertura intus 6 longa, $3\frac{1}{2}$ lata.

A small species, distinguished by its style of coloration and general form. Named after Mr. R. B. Leefe, who first discovered the species.

Family **Stenogyridæ**.

5. *Opeas juncea* (Gould).

Bulimus junceus, Gould, U.S. Explor. Exped. vol. xii. p. 76, Atlas, figs. 87–87 *b*; Pfeiffer, Mon. Hel. vol. ii. p. 220.

Hab. Sandwich Islands, Society Islands, Fiji, Upolu.

As is well known, certain forms of this group (Stenogyridæ) have an enormous geographical range; hence it is not surprising that this species should occur at such remote localities as the above.

Family **Achatinellidæ**.

6. *Tornatellina aperta*, Pease.

Tornatellina aperta, Pease, Proc. Zool. Soc. 1864, p. 673; Pfeiffer, Mon. Hel. vol. vi. p. 264.

Hab. Tahiti (*Pease*); Rotuma (*Gardiner*); Tongatabu (*Leefe*).

The type from Tahiti is a little larger and somewhat browner than the shells from Rotuma, but is similar in other respects. The bidentate columellar projection within the aperture is very remarkable and readily distinguishes this peculiar form.

Family **Succineidæ**.

7. *Succinea rotumana*.

Testa ovata, parva, cornea, lineis incrementi tenuibus striata; spira brevis, rufescens; anfractus $2\frac{1}{2}$, perconvexi, celeriter accrescentes, ultimus maximus, oblique valde descendens; apertura ovata, longit. totius $\frac{3}{4}$ fere æquans, intus plus minus iridescens; columella tenuis, arcuata, superne anguste reflexa, appressa.

Longit. $8\frac{1}{2}$ millim., diam. $3\frac{3}{4}$; apertura 6 longa, $3\frac{1}{2}$ lata.

A small species, with a mammiform spire and rather like

S. venusta, Gould, from the Hawaiian Islands. Like many other so-called species of this genus, the present one offers very slight distinguishing features from several others.

Family **Helicinidæ.**

8. *Helicina modesta*, Pfeiffer.

Helicina modesta, Pfr. Proc. Zool. Soc. 1853, p. 52; Mon. Pneumon. vol. ii. p. 186; Sowerby, Thes. Conch. vol. iii. pl. cclxxi. figs. 221, 222; id. Conch. Icon. vol. xix. pl. xxix. figs. 259 *a*, *b*.

Hab. Solomon Islands and New Hebrides.

9. *Helicina fulgora*, Gould.

Helicina fulgora, Gould, U.S. Explor. Exped. vol. xii. p. 97, Atlas, figs. 10 *b*, *c*; Pfeiffer, Mon. Pneumon. vol. i. p. 401.

Hab. Samoa, New Hebrides, Tonga Island, Namuka; Rotuma (*Gardiner*).

H. articulata, Pfr., *H. zebriolata*, Pfr., and *H. Brenchleyi*, Baird, appear to be synonyms of this species.

Family **Cyclostomatidæ.**

10. *Omphalotropis rotumana.*

Testa ovata, superne acuminata, anguste umbilicata, rufescens vel fuscescens, albo irregulariter picta et strigata, interdum ad peripheriam albo vel rufo cincta; spira elongata, conoidea, ad apicem mediocriter acuminata; anfractus sex, lente accrescentes, convexiusculi, sutura subprofunda sejuncti, lineis incrementi striati, ultimus ad peripheriam tenuissime carinatus et circa umbilicum carina altera crassiuscula instructus; apertura piriformis, intus rufescens vel fuscescens, longit. totius $\frac{1}{2}$ haud æquans; peristoma intus leviter incrassatum, continuum, marginibus columellari et basali leviter expansis.

Longit. $6\frac{1}{2}$ millim., diam. 4; apertura 3 longa, $2\frac{1}{3}$ lata.

Larger than *O. solidula*, Pfeiffer, from Lord Howe's Island, with more varied colour-markings, a wider umbilicus, and a stronger keel; also larger than *O. vitiensis*, Liardet, from Fiji, broader in form and narrower in the umbilicus.

Family **Auriculidæ.**

11. *Pythia scarabæus*, Linn.

Rather a small form.

12. *Melampus luteus*, Quoy and Gaimard.

13. *Melampus fasciatus*, Deshayes.

Both banded and plain varieties.

Family **Melaniidæ**.

14. *Melania Mageni*, Gassies.

Fide the late Dr. Brot.

Family **Littorinidæ**.

15. *Littorina obesa*, Sowerby.

16. *Littorina undulata*, Gray.

17. *Littorina intermedia*, Philippi.

LXIII.—*Description of a new Snake from the Andes of Colombia.* By G. A. Boulenger, F.R.S.

Leptognathus Pratti.

Body strongly compressed. Eye moderately large, its diameter equalling its distance from the oral border. Rostral as deep as broad, just visible from above; internasals about half as long as the præfrontals; frontal as long as broad, shorter than its distance from the end of the snout, which equals the length of the parietals; nasal divided; loreal longer than deep, bordering the eye; præocular partially fused with the præfrontal; two postoculars; temporals 2+3; eight or nine upper labials, fourth and fifth or fifth and sixth entering the eye; first two pairs of lower labials forming a suture behind the symphysial; two pairs of chin-shields, broader than long. Scales in 15 rows, vertebrals strongly enlarged. Ventrals 173; anal entire; subcaudals 71. Dark brown above and below, with paler brown cross-bars, one scale wide, disposed in pairs; belly with interrupted light longitudinal streaks.

Total length 770 millim.; tail 150.

A single specimen (a female) was obtained by Mr. A. E. Pratt at Medellin, Republic of Colombia.

LXIV.—*Descriptions of Two new Mammals from West Africa.* By W. E. de Winton.

Rhinolophus micaceus, sp. n.

Colour above and below dark soft rich purplish brown, flecked with silver-grey. The fur is so fine that it is difficult to see if the hairs are truly annulated; but as the silvery speckling comes and goes as the animal is turned in the light, it appears to arise wholly from the glint of the light on the brown fur. It is not possible to give particulars of nose-leaf, the specimen being dried. Length of fur on the back 11·5 millim.

Measurements taken in flesh by collector:—

Head and body 90 millim.; tail 23; hind foot 17; ear 26; forearm 69.

Skull: greatest length 28 millim.; greatest breadth 15·3; breadth of brain-case 11·5; intertemporal constriction 3·9; basal length 22·9; between tips of canines 6·5; length of entire tooth-row 10·5.

Type (♀): Como River, 75 miles from Gaboon, 6th July, 1897.

Collected by Mr. G. L. Bates.

Anomalurus Batesi, sp. n.

Colour above dark smoke-brown, washed with yellow, producing a greenish tone; the fur of the back glinting in the light gives the appearance of greyish speckling; on the wings and lower back the yellow washing is very much more marked; all the underparts pale grey, strongly washed with lemon-yellow. The hairs of the tail gradually increase in length distally. The toes of the hind feet have tufts of bright yellow hairs concealing the nails.

Measurements taken from dried skin:—

Head and body to anus 221 millim., to back of wing-membrane 240; tail 140, with terminal hairs 179; ear 21.

Skull: greatest length 44 millim.; greatest breadth 28; interorbital constriction 11·5; height of infraorbital foramen 4·8; basal length 38; palatal length 17; palatal foramina 4·8; upper molar series 8·6; diastema 10.

Type (♂): Como River, 75 miles from Gaboon, 6th July, 1897.

Collected by Mr. G. L. Bates, in whose honour the species is named.

LXV.—*On the Change and Form of the Teeth in the* Centetidæ, *a Malagasy Family of Insectivora.* By C. I. Forsyth Major.

Among the fruits of my two years' sojourn in Madagascar is a rich series of recent Insectivora (Centetidæ), and since a considerable time must still elapse before this is completely worked out in a monograph *, I now give in a condensed shape in the following pages the most essential facts as to the change and form of the teeth in the family in question, so far as it has yet been possible to render the material available for examination.

A.

The Change of the Teeth.

Oryzoryctes tetradactylus.

Stage I. *I.d.* 1 and *I.d.* 3 have come through almost completely; of the remaining milk-teeth the tips alone protrude. The *C.d.* are the most backward.

Stage II. All milk-teeth protrude from the jaws to their full extent, with the exception of *C.d.*, of which the posterior basal cusp is not yet visible. *M.* 1 begins to protrude.

Stage III. Skull somewhat shorter than in II.—All milk-teeth are completely protruded, with the exception of *C.d. inf.*, of which the posterior basal cusp is not yet visible. The greater portion of *M.* 1 is protruded

Stage IV. All milk-teeth completely protruded, as also *M.* 1; *M.* 2 partly so.

Stage V. Like IV.; but *M.* 2 is further advanced. *I.d.* 3 *sup. dext.* on the point of falling out.

Stage VI. Skull somewhat longer than in VII. and VIII.—*M.* 1 is *in situ*; *M.* 3 *sup.* and *inf.* on the point of coming through. *I.d.* 1 and *I.d.* 3 *sup.* and *inf.* have been shed. *I.* 3 *sup.* and *inf.* altogether *in situ*; *I.* 1 *sup.* not yet completely so. *I.* 1 *inf.* is more backward on the right than on the left. *P.* 3 (Hens.) is commencing to raise *P.d.* 3.

Stage VII. Skull a shade longer than that of VIII.—*M.* 3 *sup.* is somewhat further advanced than in the latter, *M.* 3 *inf.* somewhat more backward. In the change of teeth VII. is somewhat less further advanced than VIII.

* The diagnoses of most of the new species have already been published. *Cf.* Ann. Mag. Nat. Hist. ser. 6, vol. xviii. 1896, pp. 318–322, 461–462.

Upper jaw: *I.d.* 3 has been shed and its successor is *in situ*; *I.d.* 1 has likewise disappeared, *I.* 1 not yet completely *in situ*; *I.d.* 2 still present on both sides. *P.d.* 3 still rests like a cap upon its successor. Lower jaw: *I.d.* 1 has been shed, but its successor has not yet come through completely. *I.d.* 3 has likewise been shed, and its successor is *in situ*; *I.d.* 2 is still present. *P.d.* 3 has been shed, *P.* 3 is not yet completely protruded. *C.d.*, *P.d.* 2, and *P.d.* 1 are still in place above and below. *M.* 3 *sup.* and *inf.* are nearly *in situ* and already partly in use.

Stage VIII. *M.* 3 almost protruded above, entirely so below. Upper jaw: The change of the anterior and posterior pairs of *I.* has been consummated, and the permanent teeth are *in situ*. *I.d.* 2 is still present on the left side; on the right it has been shed, and *I.* 2 is beginning to appear. In the lower jaw the change of the anterior and posterior pairs has likewise taken place, and *I.* 1 and *I.* 3 are *in situ*; *I.d.* 2 is still present on both sides, as are also all four *C.d.* *P.d.* 3 has disappeared above and below, and the *P.* 3 are almost completely in place. The posterior milk-premolars (*P.d.* 1 and *P.d.* 2) are still present.

Stage IX. But little further advanced than VIII.—*M.* 3 *sup.* is *in situ* as well as *M.* 3 *inf.* The only other difference from VIII. consists in the fact that *I.d.* 2 has been shed on both sides; *I.* 2 is not yet *in situ*. The tip of *C. sup.* is visible, *in front* of *C.d.*; *C. inf.* is coming into view on the inside of *C.d.*

Stage X. The change of the whole of the teeth is accomplished. *C.* is not yet completely *in situ*, and is consequently the last tooth to be replaced, as also its precursor is the last to appear in the milk-dentition.

Oryzoryctes hova.

Stage I. All milk-teeth *in situ*. *M.* 1 is almost entirely exposed; *M.* 2 is beginning to protrude.

Stage II. Milk-teeth as in I. *M.* 1 and *M.* 2 somewhat further advanced, *M.* 1 *inf.* completely *in situ*.

Stage III. *I.d.* 1 and *I.d.* 3 have been replaced above and below; *I.d.* 2 and likewise *C.d.* are still *in situ*. *P.d.* 3 *sup.* has been shed on the right, on the left it still rests like a cap upon *P.* 3, which is coming into position. *P.d.* 1 and *P.d.* 2 *sup.* and *inf.* are still *in situ*. All three molars are completely developed and *in situ*.

Microgale Dobsoni.

Stage I. All molars functional. In the upper jaw the whole of the milk-teeth are still present, with the exception of *I.d.* 3, which on each side is replaced by its successor. The two *I.* 1 commence to protrude behind the *I.d.* 1. In the lower jaw *I.d.* 1, *I.d.* 3, *P.d.* 3 on each side, and *P.d.* 1 on the right are replaced.

Stage II. Like I.; in addition, however, *P.d.* 1 is also replaced in the upper jaw, and the same tooth on the left in the lower. Among the adult specimens, *i. e.*, those in which the milk-dentition is replaced completely, there are several in which the skulls are shorter than that of this stage.

Stage III. Like II., with the trifling difference that *P.d.* 1 *inf.* is replaced on each side.

Stage IV. In the upper jaw *P.d.* 1, *P.d.* 3, and *I.d.* 3 on both sides, and *I.d.* 1 on the right are replaced; in the lower jaw *P.d.* 1, *P.d.* 3, *I.d.* 3, and *I.d.* 1. *I.d.* 2 is about to be shed above and below.

Microgale Cowani.

Stage I. All milk-teeth are *in situ* and functional. *M.* 2 is almost completely through the gum, and *M.* 3 is commencing to protrude.

Stage II. Milk-teeth as in I. All three molars functional. In the upper jaw *I.* 3 on the left is beginning to protrude behind and on the inside of *I.d.* 3.

Microgale Thomasi.

Stage I. All milk-teeth functional: no trace of their successors yet visible. *M.* 3 not yet completely protruded.

According to what has been stated above, in *Oryzoryctes* the milk-teeth are replaced in the following order:—*I.d.* 3, *I.d.* 1, *I.d.* 2, *P.d.* 3, *P.d.* 1, *P.d.* 2, *C.d.* In *Microgale* the replacement of *I.d.* 1 *sup.* and *I.d.* 2 takes place later, in consequence of the powerful development of its root. According to what has been stated in the case of *Oryzoryctes tetradactylus*, the milk-teeth appear in the same order as their successors.

In connexion with the foregoing a few remarks may here be introduced on tooth-formulæ and tooth-change in the Solenodontidæ and Potamogalidæ, which are closely allied to the Centetidæ.

Solenodon cubanus.—Thomas * writes the tooth-formula of *Solenodon* as follows :—

$$I.\begin{cases}1\ 2\ 3\\1\ 2\ 3\end{cases}\quad C.\begin{cases}1\\1\end{cases}\quad P.\begin{cases}1\ 0\ 3\ 4\\ \quad\ 3\ 4\end{cases}\quad M.\begin{cases}1\ 2\ 3\\ \\1\ 2\ 3\end{cases}$$
$$\begin{cases}1\ 2\ 3\\1\ 2\ 3\end{cases}\qquad\begin{cases}1\\1\end{cases}\qquad\begin{cases}\quad\ 3\ 4\\1\ 0\ 3\ 4\end{cases}$$

P.d. 3 (*auct.*) in the lower jaw is inadvertently omitted in the original.

According to this author, therefore, in both upper and lower jaws only the two posterior milk-premolars are produced. *P.* 3, Hens. (*P.* 2, *auct.*), is stated to be absent, and *P.* 4, Hens. (*P.* 1, *auct.*), to be present ; this interpretation is due to the fact that the foremost *P.* is stated not to be changed. This view has been disputed by Leche †, who writes the dental formula, based upon a single specimen that he examined, as follows :—

$$I.\begin{cases}1\ 2\ 3\\1\ 2\ 3\end{cases}\quad C.\begin{cases}1\\1\end{cases}\quad P.\begin{cases}2\ 3\ 4\\0\ 3\ 4\end{cases}\quad M.\begin{cases}1\ 2\ 3\\ \\1\ 2\ 3\end{cases}$$
$$\begin{cases}1\ 2\ 0\\1\ 2\ 3\end{cases}\qquad\begin{cases}1\\1\end{cases}\qquad\begin{cases}0\ 3\ 4\\2\ 3\ 4\end{cases}$$

It is consequently assumed that in both upper and lower jaws only the two posterior milk-premolars are present, and, moreover, that in the lower jaw the posterior *I.d.* is absent. In addition to this Leche points out as a fact especially worthy of note that all milk-teeth are of simpler structure than the corresponding teeth of the permanent set. In the young specimen of *S. cubanus* before me, the molars are indeed fully developed, but are not yet completely protruded from the jaw ; the main cusp of *M.* 3 *sup.* is beginning to come through the gum. The lower molars are somewhat further advanced. Of the incisors three *I.d.* are present above and below ; the lower *I.d.* 3 is situated on the outside and in front of the considerably larger *I.* 3 (which is in the act of coming through) and is about to be shed. The *C.d.* are present above and below. Of milk-premolars the two posterior are present in both upper and lower jaws ; the *P.* 3, Hens., are showing. According to these facts I do not consider that we are justified in denying that the latter have precursors ; on the contrary, it is probable that in the two young specimens at present known *P.d.* 3 has already been shed, like *I.d.* 3 in Leche's example. As we have seen, in the Centetidæ *P.d.* 3 is always the first among the milk-premolars to be shed ; since tooth-change sets in earlier in *Solenodon*, I suspect that

* Proc. Zool. Soc. Lond. 1892, pp. 504–505.

† Anat. Anzeiger, xiii. 1897, p. 523.

in specimens with dentition less far advanced than those at present known, *P.d.* 3 will probably still be found. It therefore seems to me to be permissible to write the dental formula of *Solenodon* as follows :—

$$I.\begin{cases}1\ 2\ 3\\1\ 2\ 3\end{cases}\quad C.\begin{cases}1\\1\end{cases}\quad P.\begin{cases}2\ 3\ 4\\2\ 3\ 4\end{cases}\quad M.\begin{cases}1\ 2\ 3\\1\ 2\ 3\end{cases}$$

According to this the dentition would agree with that of *Oryzoryctes*, *Microgale*, and *Limnogale*. In comparison with those of the Centetidæ the milk-teeth of *Solenodon* convey the impression of having undergone degeneration.

Potamogale.—Nothing as yet has been published on tooth-change in this rare animal. Nevertheless I confidently assume that the teeth figured and described by Allman * and by Dobson † as permanent ones belong to the milk-dentition. Allman's specimen was not adult, and its *M.* 3 was still hidden in the jaw, as shown by Mivart ‡ and subsequently also confirmed by Allman himself §. It may here be remarked parenthetically that, in consequence of this, Jentink's *Potamogale Allmani* ‖ falls to the ground. Similarly, the dentition figured by Dobson is that of an immature specimen; according to the statement of the author referred to, *M.* 3 has not yet protruded in this example. The solitary specimen before me (Brit. Mus. no. 75, 10. 15. 4) is even somewhat younger than the examples alluded to above, since not even *M.* 2 is completely protruded; it is therefore yet younger than my specimen of *Solenodon*, in which the majority of the milk-teeth are still present. The molariform tooth standing in front of *M.* 1 is more worn than the latter, and the teeth in front of it are also worn—a further proof that we are dealing with milk-teeth.

B.

The Form of the Teeth.

The following investigation culminates in an attempt to furnish an answer to the question, whether in the Centetidæ

* Trans. Zool. Soc. London, 1866, pp 1–16, figs. 7 and 8 (pp. 10, 11).
† 'Monograph of the Insectivora,' 1882, p. 99, pl. viii. fig. 5.
‡ Journ. Anat. Physiol. ii. 1868, p. 128.
§ Proc. Zool. Soc. London, 1867, p. 256.
‖ 'Notes from the Leyden Museum,' vol. xvi. 1895, p. 234.

the tritubercular form of molar is to be regarded as primitive, or rather as the result of a process of retrogression.

I. *The Molars.*

The homologies of the cusps of the molars in the Insectivora have already been carefully studied by Mivart nearly thirty years ago *. It was shown by this author that the upper molars of *Potamogale* to a certain extent represent a transitional stage between the more complicated molars, *e. g.* of the mole, with two triangular prisms each, and the simpler ones, such as those of *Centetes* and *Ericulus*, with but a single prism :—"For each of these teeth [in *Potamogale*] have three or four very small cusps developed from the external cingulum, a very large cusp arising from the internal cingulum, and two median cusps, from each of which two slightly-marked diverging ridges proceed outwards to the external cingulum, forming two very narrow triangular prisms, so close together that a little more approximation would reduce them to a single prism, such as exists in *Centetes* and *Solenodon*." He also says :—"*Potamogale* shows . . . . . a very interesting approximation of the triangular prisms, the two external principal cusps still, however, remaining distinct, though in close juxtaposition. In *Centetes* it appears as if the concentration had been carried further, the two prisms uniting into one, as also the two external principal cusps. The single representative of these, however, has two small prominences on its inner side. In *Chrysochloris* we have the maximum of concentration, there being but a single triangular prism, the internal angle of which represents the two external principal cusps of *Erinaceus* and others, while internal to this there is but a single prominence to represent the two internal principal cusps."

I therefore have to state that Mivart long before myself, at least so far as the Insectivora are concerned, represented the complicated character of the molars as the primitive condition, and maintained that the simple form had arisen through concentration or fusion.

In opposition to this it was asserted by Huxley † that the form of molar seen in *Centetes* is the primitive one, and, as is well known, this view was subsequently supported also by Cope, Osborn, and Schlosser. Huxley terms the form in question "least-modified," and, according to him, the form of molar exhibited by all Carnivora is easily to be derived

* Journ. Anat. and Physiol. ii. 1868, p. 117 *et seq.*
† Proc. Zool. Soc. London, 1880, pp. 283–284.

from it. To his question, "Why may not *Hyænodon* and *Pterodon* be an extreme development of that type of the Insectivora which is at present represented by *Centetes*?" Winge* returned the categorical answer, "Because *Hyænodon* and *Pterodon* have not in the slightest degree a special resemblance to Insectivora, least of all to *Centetes*; there is not one single point in which *Centetes* does not stand in sharp contrast to *Hyænodon* and the Carnivora." Winge then proceeds to develop this view by interpreting the upper molars of *Centetes* in the following manner:—"The hindmost of the three outermost cusps has disappeared," he writes, "as also the posterior of the two that immediately follow these on the inner side; on the other hand, the anterior two of the original three outer cusps and the anterior of the two that immediately follow these are still present in a particularly well-developed form; we also observe remnants of a single talon, which in other Centetidæ is well developed." Consequently in the interpretation of the homologies Winge agrees in the main with Mivart.

I have shown in an accurately-drawn figure of an upper *M.* 1 of *Centetes* † that in a perfect condition this tooth, like that of *Potamogale*, possesses not less than five outer cusps; it is true that two of these are more strongly developed than the rest. In the figure in question I distinguished the main cusp of the tooth, situated on the inner side of those just referred to, by the numbers 4+6, in order to indicate thereby that in *Centetes* there seems to have taken place a fusion of the inner talon—6 in Winge's figures and diagrams—with the main cusp, Winge's 4.

Cope has recently ‡ reasserted his former theory, that in the existing fauna the "tritubercular" form of molar as exhibited by Centetidæ, Soricidæ, a few Lemurs, and the majority of the Carnivora is the primitive one. In Centetidæ and Chrysochloridæ the rudimentary "low cingulum" on the posterior base of lower molars and a "posterior cingulum" on upper molars are regarded as the first step towards the complication of the tritubercular molars.

M. F. Woodward § follows Mivart and Winge, since he considers the supposed "paracone" and "metacone" of *Centetes* and *Chrysochloris* to be homologous with the "ex-

* Vidensk. Meddel. fra d. naturh. Foren. i Kjöbenhavn, 1882, p. 58.

† "On *Megaladapis madagascariensis* &c.," Phil. Trans. R. Soc. Lond. vol. 185, 1894, B, p. 23, fig. 4.

‡ 'The Primary Factors of Organic Evolution' (Chicago, 1896), pp. 145, 335.

§ Proc. Zool. Soc. London, 1896, pp. 588, 589, and pl. xxvi.

ternal cingulum cusps" of *Talpa* &c., and the inner talon of *Chrysochloris*—he is not acquainted with the Centetid genera in which this is likewise distinctly preserved—with the "protocone" of *Talpa*. He regards the main cusp of the tooth of *Centetes* as homologous with the "paracone" of *Talpa*, wherein he agrees with Winge. He, however, proceeds to say:—"I do not think that the ontogeny of the tritubercular insectivore molar justifies Mivart's fusion theory, but rather suggests that this tooth corresponds only with the paracone triangle of the Mole's tooth." In other words, Woodward on the whole favours the tritubercular theory; this merely because the "paracone"—5 in his figures on pl. xxvi.—being ontogenetically the first molar-cusp to appear, he infers from this circumstance that it is the primitive cusp in a phylogenetic sense as well. He asserts, but does not demonstrate, "that as regards the primary cone, its ontogeny recapitulates its phylogeny."

That it is not merely the *anterior* "trigon" of more complicated teeth (*Talpa* &c.) with which the upper molar of the Centetidæ and Chrysochloridæ is homologous, is at once evident from the fact that the sides of the unique trigon in the latter families embrace not only the anterior but also the posterior half of the outer "cingulum-cusps."

The above-mentioned text-figure in the paper on *Megaladapis* was given by me in conjunction with four others, as representatives of four families of Malagasy mammals (belonging to three different Orders) with so-called tritubercular molars. My object was to show (1) that, as a rule, on close examination the tritubercular teeth are nevertheless found to consist of more components than only three cusps; (2) that the fact that "trituberculy" occurs in different orders is in itself sufficient to point to convergence, and the more so since the genera in question are highly specialized in other respects also; (3) that the three main cusps of the teeth with which we are dealing have *different homologies* in each of the three orders (Lemuroidea, Carnivora, Insectivora)—a further support for the assumption that convergence has taken place. This circumstance has escaped Woodward's attention, or he would hardly consider that his interpretation of the molars of *Centetes* and *Chrysochloris* brings them into complete agreement with the molars of mammals in general.

So much for the more historical part of our subject.

That the complicated mammalian molars will ultimately be traceable to a simple form I have never denied, and have even expressly stated as much; but how far back we shall have to go to find this simple condition the future will show.

For my part I have not ventured to trace the form of molar seen in Tertiary mammals to that of the older Mesozoic fossils, because, on the one hand, the hiatus between the faunæ of the Lower Eocene and those of the Jura has hitherto been too great, and because, on the other, all sorts of data are still requisite before the mammalian nature of the majority of fossil remains from the Purbeck, Stonesfield, &c. is demonstrated beyond the possibility of doubt.

We are upon firmer ground with regard to a portion of the Laramie mammals, which unhappily are for the moment still very few in number and generally isolated. Here, in the Upper Cretaceous, we meet, almost without exception, with polybunous teeth, and this, indeed, equally among the Multituberculata as among the so-called Trituberculata *; in the following comparison with the Insectivora we have to deal with the latter alone. The best-preserved upper-jaw teeth among these † are remarkable, in the first place owing to the extraordinary development of the external series of cusps, to only two of which Osborn gives names—*parastyle* and *metastyle*—while, as in the case of Didelphyidæ, Dasyuridæ, and Insectivora, from four to five cusps are present; in the second place owing to the considerable vertical and horizontal extent of the internal talon ("protocone"), which is even bulkier than in Didelphyidæ, and to which, flanking the talon on the outer side, are, moreover, superadded two smaller intermediate tubercles—the *protoconule* and *metaconule*. In correspondence with this, the talon ("talonid") on the lower molars also is remarkably strongly developed.

Among Insectivora we meet with a similar profusion of tooth-cusps in *Galeopithecus*, *Urotrichus*, *Myogale*, &c.; these genera, however, in addition to this show specialization in the shape of a commencing solenodonty. The external cusps have diminished in bulk; similarly the talon also of the upper molars is of more moderate dimensions than in the teeth from the Cretaceous, and the "intermediate tubercles" are correspondingly enlarged. In *Myogale* the hindmost of the latter —the "metaconule"—has shifted its position more towards the inside, and, at least in the case of *M.* 1, it is almost equal to the talon in bulk: the question suggests itself whether we may not find herein an indication of the mode of origin of many "quadritubercular" mammalian molars.

Potamogale.—In this genus, as has been mentioned above,

* H. F. Osborn, "Fossil Mammals of the Upper Cretaceous Beds," Bull. Amer. Mus. of Nat. Hist. vol. v. 1893, pl. viii.

† *Loc. cit.* pl. viii.

the tubercles of the second series from without—the "paracone" and "metacone"—are found to be in close juxtaposition; the talon has diminished in size, but nevertheless attains to about two thirds of the height of the "paracone." Intermediate tubercles as such are not present; on the other hand, from both sides of the talon, in the neighbourhood of which they broaden out to a certain extent, two basal ridges run towards the exterior along the anterior and posterior margin of the tooth, the anterior one reaching the external margin, while the posterior ends at about the middle of the tooth.

Solenodon.—The "paracone" and "metacone" are fused together, in consequence of which the molars have become still narrower than in the foregoing genus. The talon, too, has diminished still further in height and extent. The posterior basal margin ends on the inside, in line with the talon, in a more feebly developed tubercle, the homologue of the "metaconule" of *Myogale*.

In *Centetidæ* the "paracone" and "metacone" likewise appear to be fused together. That it actually is a case of fusion, *i. e.* that the main cusp of the molars is not to be regarded as homologous with the "paracone" alone, is shown, on the one hand, by the state of things in *Potamogale*, in which the molars in this and other respects occupy an intermediate position between those of Insectivora with "paracone" and "metacone" widely separated one from another and those with an unpaired main cusp (Solenodontidæ, Chrysochloridæ, Centetidæ), and, on the other, by the condition seen in *Oryzoryctes*. In the intact *M.* 1 of this genus, as also in the intact *P.d.* 1—in the case of *O. hova* more distinctly than in that of *O. tetradactylus* and *O. niger*—the "paracone" appears bicuspid; the posterior cusp is much less developed than the anterior, and, as in the case of *Potamogale*, is shifted somewhat further than the latter, towards the outside. In *Oryzoryctes* this metacone occurs besides in *P.d.* 2 (Hens.) and *P.d.* 3 (Hens.), and is seen with great distinctness in their successors *P.* 2 and *P.* 3. In the case of *Microgale* I find that it is present neither in the molars nor in the premolars, with the sole exception of *P.d.* 2 (Hens.).

The talon ("protocone") in Centetidæ is reduced still further than in *Solenodon*, until it entirely disappears (*Centetes*); on the other hand, in the latter genus the anterior and posterior basal ridges on both sides of the internal base of the united para- and metacone swell up in the shape of cusps, the posterior to a greater degree than the anterior; the former appears as an independent cusp on *P.* 1 and *P.* 2.

Since the united para- and metacone extends to the inner margin of the tooth, and the "protocone," from *Potamogale* onwards, appears more and more coalesced with the former, it is probable that the continually diminishing "protocone" has gradually been absorbed by the para- + metacone. The state of the case in the molars of *Ericulus* and *Echinops* is similar to that which is seen in *Centetes*; there is no occasion here to go further into details.—In *Oryzoryctes* the protocone is still of relatively considerable size, bicuspid in the case of the two anterior molars and in *P.* 1, most distinctly so in the latter: the posterior cusp, which appears unusually little developed in *M.* 1 and *M.* 2, will have to be interpreted in the same manner as in *Solenodon*.—In *Microgale Dobsoni* also the feebly developed talon is bicuspid.—In *Limnogale* it is even tricuspid in the case of perfect teeth.—The maximum of reduction seen in Centetidæ occurs in *Hemicentetes*. The talon is still indicated only in the case of *M.* 1; the external cusps, with the exception of two, on the anterior and posterior margin, are to all intents and purposes suppressed; the united para- and metacone is of considerable height. Moreover the teeth are compressed longitudinally, parallel to the longitudinal axis of the body, the last two upper molars less so than the rest.—*Geogale* is not known to me by personal examination.

After the above analysis of the molar components in the Centetidæ it is not difficult to give an answer to the question with which we started—namely, whether the form of molar that occurs in this family (as also in the Solenodontidæ and Chrysochloridæ) is to be regarded as primitive, as is pretty generally assumed, or, rather, as the result of a reduction. It is manifest that it is only the richly developed external cusps which are a primitive feature, because, indeed, throughout the mammalian class these cusps present themselves as an archaic phenomenon. I do not venture to go so far as Winge, who regards them as homologous with the three cusps of the *Triconodon*-tooth. But we found them developed to the fullest extent in Laramie teeth, next to which they are most pronounced in the low groups Polyprotodontia and Insectivora; in other orders in the case of their oldest representatives.

Undoubtedly of a secondary character, and to be regarded as a retrogression, is, according to what has already been stated, the fusion of the "paracone" and "metacone"—a phenomenon met with elsewhere among mammals only in premolars and rarely in the *M.* 3 *. The united para- and

* It is only in *Notoryctes*, which in other respects also is highly

metacone, which in Centetidæ continually advances further inwards, gradually replaces in function the "protocone" (talon), which in consequence becomes superfluous. In the interpretation of the homologies the two have been pretty generally confounded with each other, *i. e.* paracone + metacone is regarded as the "protocone."

As I would finally point out yet once again, the three main cusps of the crown—upon which the theory of the tritubercular form of the dentition of Centetidæ is based—accordingly consist externally of the two most strongly developed of the outer cusps, the *parastyle* and *metastyle* of Osborn, and internally (apex of the triangle) of the paracone + metacone, united to form a single cusp. In cases where similar forms occur among the Lemuridæ the two outer cusps are constituted by the paracone and metacone. Like Winge, I have interpreted * the apex in Lemuridæ as being homologous with the "protocone" of other mammals—Winge's 6.

With regard to the *lower molars* I can express all that I need to say here in a very few words. A characteristic feature in these teeth is the extensive reduction exhibited by the "talon," which usually appears only as a low posterior basal cusp. The lower molars, therefore, essentially consist of the anterior trigon (Osborn's "trigonid") alone. When we consider that the talon (Osborn's "talonid") is developed to the fullest extent among mammals belonging to the Lowest Tertiary † and Upper Cretaceous ‡ Beds, it appears, in connexion with all that has been stated above in the case of the upper molars, unjustifiable to wish to regard the form of the lower molars in Centetidæ as of a primitive type.

II. *The Antemolars.*

Leche remarks § with reference to the upper incisors and canines of Centetidæ (*Microgale*, *Ericulus*, *Centetes*), that they are provided with accessory cusps more abundantly in

specialized and forms a parallel to Centetidæ, and still more to Chrysochloridæ, that this fusion likewise occurs in all molars; the protocone in *Notoryctes* is still developed to a considerably greater extent than in Centetidæ.

* "On *Megaladapis* &c." (*vide suprà*), p. 23, text-figs. 1 and 2.

† *Cf.* Lemoine, "Etude d'ensemble sur les dents des Mammifères fossiles des environs de Reims," Bull. Soc. Géol. de France, 3e série, t. xix. 1891, pls. x., xi.

‡ *Cf.* H. F. Osborn, "Fossil Mammals of the Upper Cretaceous Beds," Am. Mus. Nat. Hist. vol. v. art. xvii. (New York, 1893), pl. viii. figs. Hl, Al.

§ Anat. Anz. xiii. p. 520.

the milk-dentition than in the permanent set. This applies on the whole to the same teeth in the lower jaw also, as well as to the milk-premolars. Moreover, before proceeding to discuss the facts of the case somewhat more in detail, I would premise, by way of a general observation, that in the Centetidæ there is rather less difference between the accessory and the main cusps (the former being more, the latter less strongly developed) in the milk- than in the permanent dentition.

1. *Upper Jaw.*—The least divergence in form between the premolars and molars is found in *Echinops*, the premolars of which differ to an extraordinary degree from those of *Oryzoryctes hova*, which in this respect forms the opposite extreme. The closest approach to *Echinops* is exhibited by *Ericulus*.

In *Echinops* and *Ericulus*, *P.* 1 (Hens.) is hardly distinguishable from *M.* 1; the difference from the molars—and from *P.d.* 1—to be discussed later on, in the position and height of the antero-external cusp, is demonstrable only in teeth which are intact. In both genera *P.* 1 is somewhat longer than *M.* 1, and in *Echinops* it is also somewhat broader (in the transverse direction) than the premolar of *Ericulus*; in the former there is found a low "protocone" and "hypocone."

In *Ericulus* *P.* 2 already assumes the form of a carnassial; this is much less the case in *Echinops*, in which the same tooth is as yet more like a molar, since here the antero-external cusp does not extend so far forwards, and the whole tooth appears altogether less elongate than *P.* 2 and *P.d.* 2 of *Ericulus* (I am not acquainted with *P.d.* 2 of *Echinops*). *P.* 2 of *Echinops* has in addition a distinct internal cusp ("protocone"), and that of *Ericulus* has two such cusps like *P.* 1 of *Echinops*.

P. 3 of *Echinops* resembles a carnassial; but the antero-external cusp is very slightly marked. Three roots are present, and the inner one bears a fairly large internal cusp. The milk-tooth agrees with its successor in form.

In comparison with *P.* 3 of *Echinops*, the corresponding tooth in *Ericulus* is somewhat reduced, and the secodont form begins to be seen: the longitudinal diameter is the greater, while in *Echinops* the transverse expansion is the more pronounced. There are but two roots. A feebly developed basal margin, as the remains of an internal cusp, is confined to the posterior half of the inner side. A remnant of the external cusps, likewise limited to the posterior half of the tooth, is present, as well as in many cases a

feeble antero-external cusp besides. The milk-tooth is similar in shape; only the external cusps and the internal cusp are more strongly developed; it is also provided with an anterior basal cusp.

The remains of the external cusps are even yet occasionally found in the case of the *C.d.* of both genera; for *Ericulus* see Leche's paper *; they are still better developed on the *C.d.* of *Echinops*, which likewise possesses in addition a slight anterior basal cusp. On the *C.d.* of both genera are also found remains of an interior basal cusp.

Centetes.—As in the case of *Echinops* and *Ericulus*, *P.* 1 *sup.* differs very little from the milk-tooth and from *M.* 1; it is true that here also the antero-external cusp is somewhat more independent and is placed higher up, but the difference is perceptible only in teeth which are intact. Apart from this, the tooth is more quadrate in outline, and the triangle formed by the external cusps and the united para-+metacone does not project so far towards the interior as in its precursor in the milk-dentition and in the molars.—*P.* 2 is the largest and tallest in the molar series; it possesses a fairly large postero-internal cusp, as well as a minute anterior basal cusp; of the remaining external cusps only a single one, confined to the postero-external angle, is present. The transition in form between this tooth and the small secodont *P.* 3, in which the anterior basal cusp is wanting or only just indicated, is quite abrupt. It is different in the milk-dentition: *P.d.* 2 is a tooth of a very elongated shape, with external cusps better developed than in the case of its permanent tooth; the foremost of these particularly is more strongly developed than in the latter, and especially than in the permanent tooth of *Ericulus* and *Echinops.*—*P.d.* 3, although already strongly compressed longitudinally, and without, or only with a slight indication of an anterior basal cusp, still shows in fresh specimens traces of the postero-external cusps; it exhibits, further, a remnant of an internal cusp, and, lastly, an accessory cusp behind and below the main cusp (as on *P.d.* 2, *P.d.* 3, *P.* 2, and *P.* 3 of *Oryzoryctes*—see below); this, however, is wanting on certain specimens, in which case the posterior basal cusp is more strongly developed.—Of the milk-incisors the foremost pair alone possesses a distinct posterior basal cusp; in the case of *I.d.* 2 and *I.d.* 3, which in the fresh condition are uncinate and recurved, this is scarcely indicated. On the other hand,

* Anat. Anz. xiii. p. 521, fig. 4.

contrary to what is stated by Leche *, younger specimens of *I.* 1 and *I.* 2 always possess a well-developed posterior basal cusp.

In the case of *Oryzoryctes*, *Microgale*, and *Limnogale* *P.* 1 may at once be distinguished from *P.d.* 1 by the fact that it resembles *M.* 1 much less than the latter does, which is especially evident in the condition of the external cusps; the foremost of these lies, in the case of *P.d.* 1 and the two anterior molars, in the same longitudinal row as those following it; in the premolar it is set higher up and is separated by a greater gap from those behind. As already mentioned, this difference is much less distinct in the case of *Centetes*, *Ericulus*, and *Echinops*.

The number of the external cusps on fresh cheek-teeth of the molar series is from four to five in *Microgale*, on *P.d.* 1 usually five; in *Oryzoryctes* five on *P.d.* 1, as on *M.* 1 and *M.* 2. These external cusps are divided by a median gap into an anterior and a posterior series; where five cusps are present, there are in some cases two cusps in the anterior and three in the posterior division—in others the reverse. In *P.* 1 only three external cusps are found; in the case of *Microgale* the median one, in comparison with that on either side of it, has become disproportionately large and lofty. With reference to the various species of *Microgale* the following remarks must be made. *M. Dobsoni*: *P.* 1 corresponds in its carnassial-like condition pretty closely with the *P.* 2 of *Ericulus*, and similarly *P.* 2 of *M. Dobsoni* is almost identical with the *P.* 3 of *Ericulus*; at the most, in the case of the former, the internal cusp is somewhat more strongly developed; nevertheless in the latter also the tooth, as already mentioned, has but two roots. *P.* 3 is a secodont tooth with two roots; this applies to all species of *Microgale*. —In *M. Cowani* *P.* 2 differs but little from *P.* 1; in height especially the two teeth are about equal, while in *M. Dobsoni* *P.* 2 is much lower than *P.* 1. *P.* 2 is only slightly more compressed, and in consequence somewhat more elongate; the "protocone" is developed to precisely the same extent as on *P.* 1. A much greater amount of compression is shown by *P.* 2 in the case of *M. Thomasi*, in which also the "protocone" is unusually reduced in comparison with that of *P.* 1. In the genus *Microgale* the maximum of compression (parallel to the longitudinal axis) is found in the case of *M. gracilis*; nevertheless a feebly developed "protocone" is still present on *P.* 2, while in the case of the tooth

* *Loc. cit.* p. 519.

of *M. pusilla*, which in other respects has undergone less compression, this has disappeared.

In the case of *Oryzoryctes tetradactylus* and *O. niger* the compression of *P.* 1 has proceeded still further, as is shown *inter alia* by the considerable reduction of the median external cusps; as in *Microgale*, three of these cusps are present on *P.* 1 of *Oryzoryctes*, but the middle one is not so predominantly developed as in the case of the former genus; the first is somewhat larger, the second smaller than in *Microgale*. The "protocone" still has the same extent as on *M.* 1 and is bicuspid. Owing to its more compressed form *P.* 1 agrees much more closely with *P.* 2 of *Microgale* than with *P.* 1 in the latter genus. *P.* 2 has undergone even more compression: the median external cusps are distinguishable merely as vestiges on teeth which are intact; the "protocone" is reduced to a minimum. The perfectly secodont *P.* 3 is of considerable height; it projects above *P.* 2. Both *P.* 2 and *P.* 3, as well as their precursors, show on the blade, behind the main cusp and halfway up between this and the alveolar margin, an accessory cusp, the interpretation of which as the homologue of the metacone of the molars has already been discussed.—In *Oryzoryctes hova* even *M.* 1 already exhibits the general outlines of a carnassial tooth. In *P.* 1 the compression in the longitudinal direction has made to a certain extent still further progress than in the case of the other species; the "protocone" is likewise bicuspid. *P.* 2 is altogether secodont, without a trace of median external cusps or "protocone."

2. *Lower Jaw.*—In *Echinops* and *Ericulus P.* 1 and *P.* 2, as well as their precursors in the milk-dentition, resemble molars; accordingly even *P.* 2 is provided with a stout internal cusp, Osborn's metaconid, of which a trace is still present even on *P.* 3 of *Echinops*. In the case of *Ericulus P.d.* 3, *P.* 3, *C.d.*, and *C.* have an internal basal margin, which is still present on the incisors also; it is much less pronounced in *Echinops*. *P.* 3 of *Echinops* has sometimes only one root. The canine, which is always single-rooted, exhibits now and then a slight median groove down the root.

Centetes.—Both *P.* 1 and *P.d.* 1 are molariform, but *P.* 1 is larger than the molars. *P.* 2 is a powerful tooth, almost resembling a canine; like the corresponding tooth in the upper jaw, it is higher than the posterior molars. An indication of an anterior basal cusp is found only in certain cases; a posterior basal cusp is present in the form of a talon, which

occupies the entire breadth of the tooth. Lastly, a slight internal tubercle ("metaconid") also occurs. *P.* 2 differs from *P.d.* 2 to a not inconsiderable extent; the latter is elongated, with a strongly developed anterior basal cusp, and possesses an accessory cusp situated on the same level as the "metaconid" (but on the outer side of the main cusp), than which it is sometimes rather more, sometimes rather less strongly developed. The dimensions of *P.* 3 are variable, but this tooth is always smaller than *P.* 2; an anterior basal cusp is indicated now and then, and sometimes an accessory cusp in addition, behind and below the main cusp. The latter is on *P.d.* 3 sometimes of really considerable bulk, and almost as strongly developed as on *P.d.* 2; on other specimens no trace of it is to be seen. Occasionally, even on perfectly fresh teeth, there is no vestige whatever of an anterior basal cusp in the case of *P.d.* 3 (*cf.* Leche, *loc. cit.* p. 519).

These variations, as well as the similar ones in teeth belonging to the upper jaw, suggest the idea that we have to deal with more than one species. I may add that I assume the existence of two species of *Centetes* for reasons other than those advanced by Bardeleben, but I cannot here enter further into this question.—All three milk-incisors show, as do their successors, a posterior basal cusp.

Microgale.—*P.* 1 alone is molariform, and consequently provided with an internal cusp ("metaconid"), which is wanting in the case of the two anterior premolars, but, in the majority of species at any rate, is still present on *P.d.* 2. *P.* 2 is somewhat larger than *P.* 3, but in other respects the two teeth are alike: they are secodont, with a median main cusp, an anterior and posterior basal cusp, and two roots. It is only in the case of *M. pusilla* that *P.* 3 has a single root and is similar in build to the *C.*, *i. e.* not elongate, but shortened and inclined obliquely forwards; the anterior cusp is indicated only by a slight indentation in the margin, which occurs high up near the main cusp. As regards the form of *P.* 3, *M. longicaudata* forms a transition between *M. pusilla* and the remaining species (*M. Dobsoni*, *Thomasi*, *Cowani*, *gracilis*, and *longirostris*).

Oryzoryctes.—In the build of the lower premolars this genus agrees essentially with *Microgale*. In comparison with *P.* 2, *P.* 3 is somewhat simplified, owing to the fact that the basal cusp is absent or scarcely indicated. A characteristic feature in the dentition of *Oryzoryctes* is the unusually large and powerful *C.* in both upper and lower jaws; in the case of

O. hova this tooth is even somewhat more strongly developed than in that of the other two species. (The *C.* of *Microgale* is generally much feebler—fairly stout only in *M. pusilla*.) The tip of the *C.* of *Oryzoryctes* is recurved, more so in the lower than in the upper one. All the canines have a posterior basal cusp, which is more strongly developed in those of the upper jaw.—The upper *I.* 1 converge towards each other and are provided with a strongly developed posterior basal cusp; *I.* 2 has, as in the case of *Microgale* (*cf.* Leche, *loc. cit.*), an anterior and a posterior basal cusp, of which the former is still present even in the feebly developed *I.* 2 of *M. gracilis*. *I.* 3 is rudimentary, with indications of anterior and posterior basal cusps. Of the lower *I.* the middle one is the strongest, the hindmost the weakest and similar in form to *I.* 3 *sup.* *I.* 1 and *I.* 2 are provided with a posterior basal cusp (*I.d.* 2 appears to possess two).

Thus we see—to recapitulate the morphological relations of the premolars, at least for the extremes of our series—that *P.* 1, *P.* 2, and *P.* 3 in the upper jaw (*M.* 1, *P.* 1, and *P.* 2 in the lower) of *Echinops* correspond to *M.* 2, *M.* 1, and *P.* 1 of *Oryzoryctes hova* in general form, and therefore without doubt in function also. Analogues of the two secodont teeth —*P.* 2 and *P.* 3 *sup.*—of *O. hova* are entirely wanting in *Echinops*. As has been mentioned above, the *C.d.* of *Echinops* and *Ericulus* are still more premolariform than those of all other Centetidæ which have here been discussed, while their *I.*, in the permanent set at least, are not more complicated than those of *Microgale* and *Oryzoryctes*—rather the contrary. Up to a certain point, therefore, in the case of *Echinops* and *Ericulus*, *C.* and the posterior *I.* assume the functions exercised by the anterior premolars in the case of other genera.

This condition *partly* coincides with that to which Leche has drawn attention and termed "release (*Entlastung*) and reduction of the middle antemolars with simultaneous higher development of the anterior incisors" *, which we now have briefly to discuss.

According to Leche's detailed account of this process †, the part played therein by the lower *I.* 1 and *C.* is especially characteristic. "The former," he writes, "is reduced to the same extent as *I.* 2 is developed, and it finally disappears altogether, so that in the lower jaw it is *I.* 2 that attains to the degree of development corresponding to that of the upper

* Anat. Anzeiger, xiii. 1897, pp. 521, 522.

† "Zur Entwicklungsgeschichte des Zahnsystems der Säugethiere &c.: I. Ontogenie," Bibl. Zool. Heft 17, 1895, p. 39.

I. 1. In connexion with this process *C.* exhibits all gradations from the typical development down to complete agreement with the surrounding incisors or premolars." In his subsequent paper the author in question states that *Echinops* is the only member of the Centetidæ that has taken this direction.

A somewhat similar state of things is found among Centetidæ also in the case of *Microgale Dobsoni* and *Limnogale*. Besides, in the various genera that here come under consideration we are confronted with slightly different processes, which must be kept distinct. A commencement in the direction of *Echinops* is already perceptible in the case of *Ericulus*, since the upper *I.* 1 and the lower *I.* 2 have increased in strength, although they do not, as in *Echinops*, surpass the corresponding *C.* In both genera *I.* 1 *inf.* has been but little affected, though the upper and lower *I.* 3 (and *I.d.* 3 previously) have suffered all the more and have been completely suppressed. The case is much the same with regard to *M. Dobsoni*. It is true that here we still have three incisors above and below, but the lower *I.* 3 is a very inconspicuous tooth, which in old individuals may be wanting on one or both sides. The upper *I.* 1 and the lower *I.* 2 are very powerful; the former is longer than *C.*, as in *Echinops*, but *I.* 2 *inf.* also overtops considerably the lower *C.*, while in *Echinops* both teeth are of equal strength, and in *Ericulus C.* is the larger.—In *Limnogale* the conditions are somewhat different. Here also the lower *I.* 2, like the upper *I.* 1, have been more powerfully developed than *C.*; but in the upper jaw the two posterior *I.*, the canine, and the anterior premolar have all become practically equivalent in size and form, have assumed almost the shape of canines, with recurved tips. The corresponding milk-teeth of *Limnogale* differ to no very great extent from the permanent ones, but are somewhat more dissimilar in themselves. The same statement applies to the lower *I.* 3, *C.*, and *P.* 3. The latter, which otherwise throughout the Centetidæ, with the exception of *M. pusilla* and now and then of *Echinops*, has two roots, in *Limnogale* (I have only one adult specimen before me) has a single root. Its precursor in the milk-dentition possesses in one instance two closely approximated roots; in a second example it, like *P.* 3, is single-rooted. Even the middle lower premolar (*P.* 2, Hens.) of *Limnogale* shows an approach to the form of the antemolars in front of it, and, like its precursor *P.d.* 2, it is without the internal cusp ("metaconid").

The analogy between *Limnogale* and *Potamogale* in the condition of the antemolars is obvious. In both genera we

find in the upper jaw, behind the large canine-like *I.* 1, and in the lower jaw, behind the similarly constituted *I.* 2, a series of four teeth, which, especially in the upper jaw, are very similar to each other, as an adaptation to the conditions under which these two amphibious Insectivores obtain their food, and to the change in their diet. We are confronted with a degeneration, but in combination also with adaptation, whereby (especially in the case of *Potamogale*, which appears to be more exclusively piscivorous than *Limnogale*) an approximation is furnished to the dentition of the Pinnipedia *. There is, however, this difference, that while in the case of the latter the *entire* dentition is now exclusively subservient to the functions of seizing and holding, in the Insectivores in question these are confined to the antemolars, since, as proved by the number and shape of their molars, they cannot, for the present at any rate, dispense with the *masticatory* apparatus.

LXVI.—*Descriptions of new Bats and Rodents from America.*

By Oldfield Thomas.

Dasypterus ega xanthinus, subsp. n.

Apparently similar in all essential characters to *D. e. typicus*, in spite of the wide difference in locality, but distinguished by the clearer yellow of the back, gradually brightening backwards until on the hairy part of the interfemoral the fur is quite fulvous. Under surface dull fulvous from chin to anus, the belly-hairs blackish basally, then light fulvous gradually deepening to their tips. In the typical South-American forms the back is dirty whitish, with dark tips to the hairs, and there is little or no fulvous on the under surface.

Dimensions of the type (male) :—

Forearm 47 millim.

Head and body † 68 ; tail † 48 ; hind foot with claws † 10 ; ear † 16.

Skull : greatest length 16·2, greatest breadth 11·4 ; breadth of rostrum at posterior edge of large premolar 7.

Hab. Sierra Laguna, Lower California. Six specimens examined.

D. ega is not included at all in Mr. G. S. Miller's admirable monograph of the Vespertilionidæ found north of Panama, so that its occurrence in Lower California is a most remarkable and unexpected fact, considering the extent and completeness of the collections he worked from.

* As regards the Pinnipedia *cf.* W. Leche, 'Zur Entwicklungsgeschichte des Zahnsystems der Säugethiere, I.' (Stuttgart, 1895), p. 66.

† Measured in flesh by collector.

Artibeus (*Dermanura*?) *Rosenbergi*, sp. n.

Size small. Anterior end of nose-leaf free, its sides without extra lobes, its upright portion unusually broad, nearly or quite as broad as the horseshoe. Ears of medium length, their inner margin evenly convex, tip rounded, outer margin with two slight concavities separated by a convexity, an indistinctly marked convex lobe below. Tragus straight, sharply pointed, its outer side with four or five sharp projecting points. Wings to the middle of the metatarsus. Interfemoral emarginate to the level of the distal third of the tibiæ. Distribution of fur much as in *A. glaucus*, but the hairs on the base of the pollex and the hinder limbs are much more sparse.

Colour (in a spirit-specimen) apparently dull greyish above, slightly paler below. Four indistinct facial lines perceptible.

Skull of somewhat the same general shape as that of *A. quadrivittatus*, but decidedly narrower throughout.

Upper inner incisors small, their cusps subequal; outer incisors about half the height of the inner ones. Molars less broad than usual, the posterior one ($m.^2$) scarcely more than one third the area in cross section of the first, which is itself only about one fifth broader than the posterior premolar. Lower incisors bicuspid, subequal, touching each other. Lower molars corresponding in size to those above, the second barely three fourths the length of the anterior one. An m_3 present on the left side only, so excessively minute that I am induced to consider the other side as the normal one.

Dimensions of the type (an adult male in spirit):—

Forearm 37 millim.

Head and body 54; ear from notch 14·5; tragus 4·7; nose-leaf, length 11, breadth of horizontal part 5·9, of upright part 5·8; length of lower leg 14; calcar 5; depth of interfemoral in centre 9.

Skull: basal length 16·5; greatest length 21; zygomatic breadth 11·1; intertemporal breadth 5·2; palate, length 9·7, breadth outside $m.^1$ 8·3, inside $m.^1$ 4·2; tip to tip of upper canines 4·5; front of canine to back of $m.^2$ 6·6; ditto in lower jaw 7; horizontal length of m_1 2, of m_2 1·5.

Hab. Cachavi, N. Ecuador. Coll. W. F. H. Rosenberg, 17th December, 1896.

This little species may be readily distinguished from all others by its broad nose-leaf, narrow skull, and the unusual proportions of its molars. The presence of a third lower molar on one side and not on the other is interesting, as showing the entire unreliability of the presence or absence of such teeth as a character of generic rank, and strongly

confirms Dobson's views on the subject and also those I have expressed in connexion with *Vampyrops* *.

Saccopteryx infusca, sp. n.

Similar in all essential respects to *S.* (*Balantiopteryx*) *plicata*, Pet., but rather smaller and less thickly built, much darker in colour, with decidedly narrower ears, less hairy interfemoral, and no white line along the posterior edge of the wing-membrane.

Ears narrow, inner margin faintly concave in its upper half; tip narrowly rounded off; outer margin straight above, slightly convex below. Interfemoral very thinly hairy as far as the exsertion of the tail.

Colour (from a skin) dark chestnut-brown above, scarcely paler below. *S. plicata* is slaty grey.

Dimensions of the type (an adult male in spirit) :—

Forearm 41 millim.

Head and body 42; tail 13; tail free from membrane 2·7; ear 11·3; tragus on inner edge 3·3; lower leg 16; calcar 14.

Hab. Cachavi, N. Ecuador. Coll. W. F. H. Rosenberg, 5th Jan., 1897.

S. plicata ranges northwards from Costa Rica to Sinaloa, W. Mexico, while the new form apparently extends also to Guatemala, as two bad specimens in the Museum from the neighbourhood of Coban (coll. F. C. Sarg) seem to be referable to it.

Nectomys saturatus, sp. n.

General size about as in the larger species of the genus, such as *N. grandis*, but the head, judged by the skull, seems to be larger and heavier. Colour above dark smoky grey-brown, much darker than in any of the other species, especially along the centre of the back, where it approaches black, owing to the very large number of shiny black-tipped hairs mixed with the fur. Sides clearer grey, not unlike the dorsal colour of *Mus decumanus*. Belly rather more sharply defined than usual, pale buffy, the bases of the hairs slate. Centre of face blackish, continuous with the dorsal dark colour. Ears rather short, their hairs blackish. Hands and feet brown above, a few whitish hairs intermixed, the digits nearly naked; claws whitish. Tail long, uniformly blackish and thinly hairy above; below, the longer swimming-hairs along the middle line are white.

Skull very stout and heavily built. Nasals broad in front, evenly tapering backwards to a point barely as far back as the level of the lacrymals, and but little surpassing

* Ann. & Mag. Nat. Hist. (6) iv. p. 169 (1889).

the premaxillary processes behind. Interorbital region broad, almost parallel-sided, the ridges strong, but becoming almost obsolete as they pass the fronto-parietal suture, then thickening again as they pass along the parietals. Interparietal large. Anterior palatine foramina of about the usual length, but, owing to the great size of the molars, their hinder end is only just in front of the level of $m.^1$ Incisors broad and strong. Molars excessively large and heavy, more so than in any other species.

Dimensions of the type (an adult male, measured in flesh by collector) :—

Head and body 205 millim.; tail 238; hind foot* 51; ear 23.

Skull: greatest length 47·5, basilar length 38·5; greatest breadth 26; nasals 18·5 × 6; interorbital breadth 9; interparietal 5·5 × 11·8; palate length from henselion 22·2; diastema 12·5; palatine foramina 8·2 × 3·4; length of upper molar series 8·7.

Hab. Ibarra, N. Ecuador, alt. 2225 metres. Coll. W. F. H. Rosenberg, 19th May, 1897.

This fine species may be readily distinguished from all others by its broad heavy skull, large molars, and sombre coloration.

Nectomys russulus, sp. n.

Size considerably smaller than in the known species of *Nectomys*, the general appearance being more that of a large clumsily-built *Oryzomys*. Fur straight, thick, and glossy; hairs of back about 13 or 14 millim. in length, the underfur less woolly and less markedly different from the longer fur than in the other species. General colour dark russet-brown, very uniform in tone, without special markings anywhere, the light-coloured rings of the hairs dark fulvous. On the sides, as usual, the fulvous becomes rather clearer and the general tone lighter. Belly not sharply defined, little paler than the sides, its hairs slaty basally, dull buffy or clay-colour terminally. Ears rather small, thinly haired, practically naked. Upper surface of hands and feet brownish. Tail long, excessively finely scaled, very thinly clothed, dull brownish above and below.

Skull heavily built, very like that of an ordinary *Nectomys* in miniature. Nasals evenly narrowing backwards, not contracted at their centres. Interorbital region broad and flat, its edges very strongly ridged, the ridges well developed

* Attention may be again drawn to the fact that all hind-foot measurements taken by myself or by British collectors are without the claws, as opposed to the American method of including them.

right back across the parietals to the outer corners of the interparietal, at which point they turn abruptly downwards and outwards. Anterior palatine foramina rather small, ending about 1·5 millim. in front of the level of *m.*[1] Posterior nares very broad, open and rounded.

Teeth very stout and heavy. Incisors thick and strong. Molars broad and rounded, twice the bulk of those of an average *Oryzomys* of the same size, and but little smaller than those of *Nectomys squamipes*.

Dimensions of the type (an aged female, measured by collector in the flesh) :—

Head and body 150 millim. ; tail 180 ; hind foot 35 ; ear 19.

Skull: greatest length 36, basilar length 29·1 ; greatest breadth 19·7 ; nasals 14·6 × 4·5 ; interorbital breadth 6·6 ; interparietal 3·8 × 8·5 ; length of zygoma-root 4·7 ; palate length from henselion 17 ; diastema 10·4 ; anterior palatine foramina 6 × 2·6 ; length of upper molar series 6 ; width of posterior nares 3·2.

Hab. Valdivia, Colombia, alt. 1200 metres. Coll. A. E. Pratt, 7th July, 1897.

This species bears much the same proportion to the other members of *Nectomys* that the little *Holochilus nanus* does to the large rats of that genus. It shows less obvious adaptation to an aquatic life than its congeners, although its fur is equally glossy, and there is a slight indication of webbing to the hind feet.

Oryzomys peninsulæ, sp. n.

A large species allied to *O. Couesi* and *O. fulgens*. Fur thick, close and rather woolly, about 10 millim. in length on the back. Colour of head and fore back pale greyish, gradually changing to dull fulvous on the rump, the latter colour closely similar to the general colour of *O. Couesi*. Darker lining on back little conspicuous. Under surface dull white, not sharply defined ; the hairs slaty basally. Ears thinly hairy, pale brown. Hands and feet uniformly silvery white above. Tail thinly haired, brown above, darkening terminally, whitish below. Skull stout and heavy, with well-defined supraorbital ridges.

Dimensions of the type (an adult male, measured in the flesh) :—

Head and body 148 millim. ; tail 150 ; hind foot, with claws, 34 ; ear 18.

Skull: basilar length 27·3 ; greatest breadth 18·7 ; nasals 13 × 3·9 ; palatine foramina 7 × 3 ; length of upper molar series 5.

Hab. Santa Anita, Lower California. Six specimens examined.

So far as I am aware, no *Oryzomys* has hitherto been described from Lower California, where the occurrence of one of these reddish tropical forms is a matter of much interest.

Akodon pulcherrimus, sp. n.

A large *Akodon* of a very dark colour, with prominent white ear-patches.

Size rather large. Fur long, soft and thick, 12 or 13 millim. in length on the back. General colour deep fuscous brown, perhaps nearest to Ridgway's "mummy-brown," quite unlike that of any other species known to me. The long hairs are black, the shorter hairs dark slaty basally, dull orange fulvous terminally; this colour extends over the upper surface of the face and crown, down the nape, and over the whole back and down the outer side of the forearms, but is very sharply separated on the sides from the pure white of the under surface, which not only extends from chin to anus, but runs up on each side to form a large and prominent patch below and behind the ears; the breadth between the patches, across the dark colour of the nape, is only about 10 or 11 millim. On the rump the dark dorsal colour also ends higher up than usual, and is abruptly replaced by white on the hams. The hairs of the belly, although white terminally, are slaty basally, but on the chin and ear-patches the hairs, or, at least, most of them, are snowy white to their roots. Ears of fair length, well-haired, their outer surface black anteriorly, whitish posteriorly, their inner surface with their posterior fourth black, margined in front with white. When the ears are folded the visible surface is in consequence black anteriorly and posteriorly, with whitish hairs between. Hands and feet whitish, but the heels and ankles are more or less suffused with fulvous; claws of medium length. Tail about the length of the body without the head, well-haired, prominently black above, whitish or pale fulvous below, a narrow line of deep fulvous margining the black.

Skull and teeth apparently of normal Akodont structure. Brain-case and supraorbital ridges rounded; zygomata not boldly expanded; interparietal small and narrow. Anterior palatine foramina ending opposite the first third of $m.^1$.

Dimensions of the type (an adult female, measured in flesh by collector) :—

Head and body 110 millim.; tail 80. Re-made, the skin measures 115, tail 84, hind foot (moistened) 23, ear (moistened) 15·5.

Skull: basal length 24, basilar length 22·5; greatest breadth 13·6; nasals 11·1 × 3·4; interorbital breadth 4·7; palate length from henselion 12; diastema 7·6; palatal foramina 6·6 × 2·2; length of upper molar series 4·1.

Hab. Puno, Peru, alt. 4000 metres.

Type: B.M. no. 97. 10. 3. 33. Coll. J. Kalinowski, June 15, 1896.

Of this wonderful and uniquely coloured mouse Mr. Kalinowski fortunately obtained three specimens. Had there been only one it might have been supposed to be partially albinistic.

Mr. Kalinowski also obtained in the same district examples of *Phyllotis boliviensis*, Waterh., *Reithrodon pictus*, Thos., and *Ctenomys opimus*, Wagn. Neither *Phyllotis* nor *Ctenomys* had been previously recorded from Peru.

Echimys gymnurus, sp. n.

Size about as in *E. semispinosus*. Pelage much less uniform in character than in the allied species, the spines, owing to their unusual thickness and length, contrasting markedly with the hairs, not only to the touch, but to the sight; spines uniformly distributed over the whole of the upper surface, though longer and stronger on the back. General colour deep rich ferruginous, lined with black, and much broken on the back by the black ends of the dorsal spines; the hairs throughout are dull slaty basally, with bright ferruginous tips. Spines of the central back about 29 or 30 millim. in length by 2 millim. in breadth at the broadest part near the base, whence they taper evenly to the strong sharp point; in colour they are white for their basal and black for their terminal halves, but on the sides there is a subterminal dusky band, succeeded by a pale reddish tip. Head rather darker than body, the mixture of black and rufous finer. Under surface sharply defined, white from chin to anus, the dark colour approximating a little on each side under the throat. Forearms and upper surface of hands brown, digits almost naked. Legs brown; metatarsals and digits very thinly covered with silvery hairs. Tail practically naked, the few finer hairs imperceptible without a lens, the scales large and prominent; upper surface grey, lower white.

Skull very rugged, with strongly marked ridges and crests; muzzle long and narrow. Nasals long, evenly tapering backwards, their hinder edges obliquely truncated, their line of truncation continuous with the oblique hinder edge of the premaxillary processes; their tip just level with the ascending zygomatic root. Supraorbital ridges evenly and widely curving outwards, then converging again across the parietals, along which they run as single distinct ridges nearly to the outer corners of the interparietal. Ascending root of zygoma excessively slender when viewed laterally, though more than

1½ millim. broad when viewed from in front. Palate excavated to or in front of the junction between $m.^2$ and $m.^3$. Bullæ unusually small and low, the basal bone between them much broader than in other species.

Dimensions of the type (an adult male, measured in flesh by the collector):—

Head and body 254 millim.; tail 182; hind foot 51; ear 22.

Skull: basilar length 41, greatest length 60; greatest breadth 28; nasals $22 \times 6{\cdot}8$; interorbital breadth 12·5; greatest breadth on supraorbital ledges above squamosals 23·6; interparietal $7{\cdot}5 \times 11$; palate length from henselion 19·5; diastema 12·9; palatal foramina $4{\cdot}5 \times 2{\cdot}9$; length of upper molar series 9; breadth between bullæ on basilar suture 4·5.

Hab. Cachavi, N. Ecuador, altitude 170 metres. Coll. W. F. H. Rosenberg, 27th Nov., 1896.

This handsome *Echimys* differs from Tomes's *E. semispinosus* *, also from Ecuador, but without exact locality, by its richer rufous colour, the uniform distribution of the spines over the back and flanks, the much greater length and strength of the spines themselves, the nakedness of the tail, the structure of the posterior nasal region, and the flatter bullæ. In all these points the Bogota *Echimys* assigned last year † to *E. semispinosus* agrees much better with Tomes's description than does that brought home by Mr. Rosenberg, in spite of the Ecuadorean locality of the latter.

Lepus andinus, sp. n.

Size small, about as in *L. sylvaticus*; much larger than in *L. brasiliensis*. General tone of colour dusky, the markings dull and inconspicuous. Forehead suffused with brownish; cheeks and sides of neck ashy grey. Nape dull rufous. Back rather more heavily lined with black than in *L. sylvaticus*, the bases of the hairs very dark slaty. Rump with a dull reddish suffusion, which passes down on the legs to the heels. Chin and belly dull whitish, the hairs slaty for more than half their length; chest dull slaty grey, relieved by a few buffy hairs. Ears rather short, though longer than in *L. brasiliensis*, grey basally, blackish brown for their terminal halves. Outside of forearm dull rufous, hands and feet whitish. Tail a mere stump, hidden in the fur, coloured like the rump.

Skull rather similar in general proportions to that of *L. sylvaticus*. Interorbital region slightly concave. Post-

* P. Z. S. 1860, p. 265.

† Ann. & Mag. Nat. Hist. (6) xviii. p. 312 (1896).

orbital processes not coalescing with the frontals behind. Anterior palatine foramina decidedly narrower than in *L. sylvaticus*. Bullæ small. Enamel of incisors simply following the curve of the tooth-face, not specially infolded.

Dimensions of the type (an adult female, measured in flesh by collector) :—

Head and body 340 millim.; tail 21; hind foot 68; ear 55.

Skull: greatest length 70·5, basilar length 55; greatest breadth 34; nasals, greatest length 26, greatest breadth 14·3; interorbital breadth, without ledges 14, with ledges 16·5; intertemporal breadth 12·2; palate length from henselion 28·3; diastema 19·2; palatine foramina 17·5×5·2. Molar series (sockets) 13·3.

Hab. W. slope of Cayambé Mountain, Eastern Cordillera of Ecuador, altitude 4000 metres. Coll. W. F. H. Rosenberg, 2nd July, 1897.

This is no doubt the hare referred by Tschudi and Tomes to *L. brasiliensis*, but is clearly not that species, than which it is very much larger. Probably it is most nearly allied to *L. Gabbi* and *L. sylvaticus*, but may be distinguished by its more dingy coloration.

Lepus Defilippii, Cornalia *, is evidently, by its size and locality, closely allied to, if not identical with, *L. brasiliensis*.

Lepus cumanicus, sp. n.

Size about as in *L. Gabbi*. General coloration bright and vivid, very different to that of *L. andinus*. Back very coarsely marbled, the colours strongly contrasted, the light rings on the hairs nearly white, and the long dark tips shining black. Crown grizzled brownish. Sides of face whitish, a sharply marked white ring passing around the eyes and continued as a white line upwards towards the base of the ears. Between the eye and ear, behind and below the white ring, there is a distinct black patch, contrasting markedly with the white eye-ring and white chin. Chin, belly, inner sides of hind limbs, and top of feet pure white, the hairs white to their roots. Throat grizzled pale slaty and buff. Ears of medium length, greyish basally, darkening to black terminally. Nape-patch bright rufous. Rump not more rufous than back, but the back of the hind limbs and the soles are slightly suffused with rufous. Tail very short, above slaty grey with a few buff-tipped hairs intermixed, white below.

Skull larger and heavier than in *L. andinus*; bullæ equally small; postorbital processes short, just touching but not

* In Osculati's 'Esplorazione'; see Rev. et Mag. de Zool. (2) iii. p. 615 (1851).

anchylosed with the frontals behind. Enamel of incisors with a deep though simple infolding in the centre.

Dimensions of the type (an adult female, measured in skin) :—

Head and body (c.) 390 millim.; tail (c.) 20; hind foot 83; ear 58.

Skull: greatest length 78, basilar length 61; greatest breadth 36; nasals, greatest length 33, greatest breadth 16·5; interorbital breadth, without ledges 17·6, with ledges 19·4; intertemporal breadth 16; palate length from henselion 32; diastema 22·4; palatine foramina 21·5 × 7·5. Molar series (sockets) 14·5.

Hab. Cumana, coast of Venezuela.

Type: B.M. 94. 9. 25. 18. Coll. A. Mocquerys, January 1894.

In Venezuela there also occur the widely different *Lepus nigronuchalis*, Hart., and on the Sierra de Merida, as might be expected, a dull-coloured species allied to or identical with *L. andinus*.

LXVII.—*Description of a new* Scarabæus *from East Africa.*

By Charles O. Waterhouse, F.E.S.

The British Museum has lately received some interesting insects from East Africa inland from Mombasa. Among them are four species of *Scarabæus*—*S. platynotus*, Bates, *S. catenatus*, Gerst., *S. æratus*, Gerst., and a species which I am unable to find a name for. I propose to call it *S. Bettoni*, after the collector Mr. C. Stewart Betton, to whom we are indebted for the specimens.

Scarabæus Bettoni, sp. n.

Oblongus, sat convexus, nitidus, piceo-niger; thorace sat crebre granulato, basi medio fere lævi; elytris distincte striatis, interstitiis vix convexis, nitidis, punctis parvis sparsis, lateribus bicarinatis; tibiis anticis quadridentatis, dente basali parvo; mesosterno antice dense fulvo-hirto.

Long. 44 millim.

This species belongs to the *metallicus* group, but is pitchy black, shining. It is very close to *S. venerabilis*, Harold (of which there are specimens in this Museum from Abyssinia and Uganda), but it is a little longer in the elytra. The head is densely asperate, without any frontal tubercle. The thorax

is granulate, but not quite so densely as in *S. venerabilis*, and the smooth basal area is much more extended. The elytra are striated in a similar manner, but the interstices are rather more shining than is usual in *S. venerabilis*, and the punctures scattered over the surface, although small, are very distinct. The margin is bicarinate, the inner carina being complete, and not broken up as in *S. venerabilis*. The hair on the posterior tibiæ and elsewhere is fulvous. The tarsi are very little longer than the tibial spur.

Hab. Maziwa Mitatu, Taru Desert, March 18th, 1897.

BIBLIOGRAPHICAL NOTICE.

A Memoir of William Pengelly, of Torquay, F.R.S., Geologist, with a Selection from his Correspondence. Edited by his Daughter Hester Pengelly; with a Summary of his Scientific Work, by the Rev. Professor Bonney, F.R.S., F.G.S., Hon. Canon of Manchester. 341 pages, with Portrait and ten other Plates. 8vo. John Murray, London.

Born January 12, 1812; died March 16, 1894, aged 82, it may well have been said of him—"Thou shalt come in at thy full time to the grave, as the corn is gathered to the shock at his season." We know the general history of any such grain as is here alluded to, its origin, sowing, growth, and gathering in; but of the special history of a good old man, who has passed through all the stages of a long and useful life with credit to himself and benefit to others, we require to know much from those who were his particular companions and friends. Manifold materials for this view of W. Pengelly's life exist in letters and memoranda collected by his family. These have been freely utilized in the Biography by Miss Hester Pengelly. The narrative, divided into nineteen chapters, marked off by groups of the successive years and personal occurrences, is clear and consistent, often taking in contingent parts of the correspondence and the anecdotes so characteristic of W. Pengelly's conversation. In fact, letters, anecdotes, narrative, and personal remarks are skilfully pieced together. Here and there the reader may find the transition from large to small print, and from abstract to concrete statement of occurrences, doings, and thinkings, rather inconvenient. Nevertheless the record can be taken up at any part with satisfaction; and it is often difficult to lay it down, either on account of its anecdotal clearness or from sympathetic feeling. It is full of interest both for his contemporaries, who had a living friendship with him, and for the later admirers of his powers, and students who have benefitted by his writings.

Accustomed to a seafaring life in his early years, W. Pengelly's

habits and thoughts were influenced as well by its bright, cheerful, and inspiriting aspects as by the darkness and dangers of storms and the hardships of a sailor's work. With trusty companions he weathered the tempests; and his natural gaiety, real good-nature, and high moral principles enabled him to be cheerful and straight amidst rough but well-intentioned comrades. So in after-life, through years of hard work and narrow means, hopefully and persistently he improved his knowledge as schoolmaster, and before long as tutor and lecturer in mathematics and the natural sciences. About 1840 geology attracted his attention, and ever afterwards he assiduously worked at the rocks and fossils of Cornwall and Devon in sympathy and correspondence with many geologists of note. The geological structure of the country, the fossil fishes of Polperro and elsewhere, the clay-beds and lignites of Bovey Tracey, and especially the varied contents of the Bone-Caves of Happaway Hill, Brixham, and Kent's Hole, excited his scientific energies, using up his leisure and his holidays. The results of his work, complete in itself and trustworthy in its exactitude, gave him a high standing among the intellects of the day. His knowledge was widely sought for and freely imparted. The extensive correspondence with the Author of the 'Principles' and 'Elements of Geology' alone shows what influence Pengelly's experience and philosophic acumen had on the establishment and progress of geological science.

Of Pengelly's geological work and of his various published papers (119 catalogued at pages 323–329), Dr. Bonney's Appendix (pages 291–322) is a complete, critical, and scientifically correct account, written with a deep and affectionate sympathy for the deceased friend and fellow-worker.

Mr. F. S. Ellis, an old friend and neighbour at Torquay, has written the Preface for the Memoir, with a full knowledge of his deceased friend's life and circumstances. He truly observes:—"It can scarcely fail to force itself on the reader of the ensuing pages that the special note of William Pengelly's character, apart from the energy, perseverance, clear-sightedness, wit, and abundant good humour which distinguished him, was his extraordinary unselfishness."

In many directions during his life Pengelly was in touch with different classes of society, and left incidental notes of their ways and thoughts. These collected records (1812–1894) constitute a not unimportant part of the history of British science, and, indeed, a good chapter of English history, as to the people of various degrees and conditions, in their intellectual aspect.

His influence for good affected a large circle, both of those who knew him and those who have known his writings. It was a steady light replacing the gloom around it. For the advancement of good and useful knowledge he laboured hard for many years, as the several Institutions and Museums of Devon, Cornwall, and elsewhere can testify, and as the elaborate "Memoir" before us fully shows. Not only of "Men of Might," battling against armed enemies, but

of others, fighting against ignorance and superstition, may it be said—

> "Some cherissaunce it is to gentle mind,
> When they have chevyced their land from bane,
> When they are dead, they leave their name behind,
> And their good deeds do on the Earth remain."
> (*Introduction to 'Ella'* : Chatterton.)

MISCELLANEOUS.

On a new Myxosporidian of the Family Glugeïdæ.

By Louis Léger.

The larvæ of *Simulium* (*S. ornatum*, Meig.) abound at the commencement of spring in our swift-flowing French streams, and more particularly in those of the mountainous districts of the south. They are to be found in hundreds, placed side by side and attached by the anal region to stones or blades of grass, more especially in the places where the current is most disturbed.

If these clusters of larvæ be examined with some little attention, one is struck with the very peculiar appearance presented by certain of them, in which the abdominal region is greatly swollen and of a milky-white colour, which offers a sharp contrast to the dusky green tint of the normal individuals. A careful dissection, performed under a lens, shows that these larvæ contain in the body-cavity free parasitic masses each of which forms a kind of sac of an opaque white, with irregular contours. Certain larvæ contain but one of these masses, which fills the greater portion of the body-cavity, and thus attains a length of almost half a centimetre; others exhibit two or three of them—rarely more—which together fill up the vacant spaces of the body-cavity, upon which to some extent they are moulded. Sometimes, in the case of certain greatly diseased larvæ, the parasitic sac, owing to excessive growth, has distended the superficial integuments and causes a hernia on the surface of the larval abdomen in the shape of a large and nearly spherical cyst; but most frequently the parasite in its growth simply compresses the organs of the body-cavity without injuring them in any way. Even the muscles are not injured, and the larvæ, though severely attacked, still exhibit very active movements. The fat-body alone appears excessively reduced and is often wanting, which leads to the belief that it is above all at its expense that the development of the parasite is effected. As for the digestive tract, this appears to be always immune in larvæ manifestly attacked by the parasites. On a single occasion I met with a young Myxosporidian still non-sporulated and forming a hernia on the external surface of the intestine, which shows that the migration of the vegetative stages from the alimentary canal into the cœlome takes place at a very early period and rapidly.

On being examined under the microscope the parasitic masses appear as sacs with a delicate transparent wall, the interior of

which is almost completely filled with a prodigious quantity of spores. The latter are ovoid and refringent, with a large vacuole at the swollen extremity. On being treated with iodine water they exhibit a filament fifteen or twenty times longer than themselves, which issues from their pointed extremity or summit. Here we have indeed the special characters of the spores of the Myxosporidia, and the presence of a single filament—analogous to that of which the lamented M. Thélohan was the first to succeed in demonstrating the existence in the case of *Glugea bombycis*—causes us to assign this parasite to the family Glugeïdæ.

The spores are of two different dimensions—the small ones measuring 4 μ to 5 μ, the large about 8 μ. Certain sacs contain only microspores, and the latter are always united in little groups of eight and enclosed in a frail wall; the others, on the contrary, contain only macrospores, and in this case the latter are united into spherical masses of different sizes, enclosing an indefinite number of spores, and likewise clothed with a delicate envelope. Together with these masses of spores we meet with the different phases of development of the primitive spherules—that is to say, of the spherical masses of granular protoplasm with one, two, four, eight nuclei, and so on, showing the different stages in the formation of the spores.

The characters of this Myxosporidian place it in the genus *Glugea* by the side of the other species studied by Thélohan and formerly included in the group Microsporidia. It is distinguished from the forms at present known—(1) by its habitat being exclusively confined to the body-cavity, without relations with the alimentary canal at maturity or with the other organs which always remain intact; (2) by the faculty it possesses of appearing sometimes in the form of cysts with an indeterminate number of macrospores, and sometimes in the condition of cysts enclosing only eight microspores, which shows that these two states are far from having the specific importance attached to them at present.

I shall designate the species *Glugea varians*, in order to recall this latter peculiarity.

When this Myxosporidian appears, as is most frequently the case, in the form of cysts containing eight spores, one cannot help noticing its striking analogy to *Telohania Contejeani*, Henneguy, which completely invades the muscles of the crayfish and causes the death of this crustacean.

As I thought that there might be some relation between these two parasites, especially considering the fact that the *Simulium*-larvæ are frequently met with in the streams inhabited by crayfish, I attempted, in collaboration with Dr. Hagenmüller, to infest crayfish artificially by causing them to consume infected larvæ. Hitherto our experiments have not yielded positive results. Perhaps the spores only recover their virulence provided they pass into the intestine of a vertebrate, as Krassilschtchik maintains in the case of the *Glugea* of the *Bombyx*. We shall attempt to verify this subsequently.—*Comptes Rendus*, t. cxxv. no. 4 (July 26, 1897), pp. 260–262.

INDEX TO VOL. XX.

Acanthodesmus, new species of, 433.
Acidalia, new species of, 91.
Adelomorpha, new species of, 416.
Akodon, new species of, 216, 549.
Alecto, new species of, 60.
Aliciidæ, on the Actiniarian family, 1.
Allactaga, new species of, 309.
Amphidromus, new species of, 211.
Anacropora, notes on the genus, 127.
Anaglymma, new species of, 180.
Andrena, new species of, 512.
Anisolabis, new species of, 311.
Annelids from Norway, on a collection of, 172.
Anomalurus, new species of, 524.
Anthias, new species of, 420.
Apera Burnupi, on the anatomy of, 221.
Apluda, new species of, 204.
Apobletes, new species of, 356.
Arachnida, new, 253, 342.
Arbela, new species of, 209.
Argyroeides, new species of, 304.
Arius, new species of, 296.
Aroa, new species of, 201.
Artibeus, new species of, 545.
Arvicanthis, new species of, 318.
Asthena, new species of, 84.
Baptria, new species of, 89.
Barbastella, note on the genus, 384.
Batrachians, new, 365.
Bats, on the nomenclature of some European, 379.
Beralade, new species of, 208.
Bernard, H. M., on the Madreporarian subfamily Montiporinæ, 117.
Bizone, new species of, 198.
Blossia, new species of, 271.
Böhmig, Dr. L., on the excretory organs and blood-vascular system of Tetrastemma græcense, 324.
Bombycomorpha, new species of, 207.
Books, new:—Reuter's Ueber die Palpen der Rhopaloceren, 114; M'Intosh and Masterman's Life-Histories of the British Marine Food-Fishes, 399; Poynting's Eggs of British Birds—Limicolæ, 404; Trouessart's Catalogus Mammalium, fascc. i. & ii., 405, fasc. iii., 482; Postlethwaite's Geology of the English Lake District, 407; Newton's Dictionary of Birds, 479; A Memoir of William Pengelly, of Torquay, 554.
Bordage, E., on phenomena of autotomy in nymphs and adults of Phasmidæ belonging to the genera Monandroptera and Rhaphiderus, 473, 476; on the tetrameric regeneration of the tarsus in Phasmidæ, 507.
Boulenger, G. A., on a new Ceratopterine eagle-ray from Jamaica, 227; on a collection of fishes from Brazil, 294; on a new species of Sternopygus, 305; on the reptiles of Rotuma Island, 306; on fishes from Rotuma, 371; on little-known snakes from Natal, 374; on new fishes from Persia, 420; on new fishes from the Upper Congo, 422; on a new snake from Colombia, 523.
Brabira, new species of, 72.
Bryozoa, new Cyclostomatous, 60.
Bubalis, new species of, 376.
Bulimulus, new species of, 213.
Bunodeopsis, new species of, 7.
Burr, M., on new species of Forficularia, 310.
Butler, Dr. A. G., on the Pierine butterflies of the genus Delias, 143; on new species of Catasticta, 366; revision of the genus Teracolus, 385, 451, 495.
Calanotos, new species of, 300.
Calcagninus, new species of, 19.

Cambogia, new species of, 88.
Cambridge, F. O. P., on the Cteniform spiders of Ceylon, Burmah, &c., 329.
Caphara, new species of, 209.
Catasticta, new species of, 366.
Centetidæ, on the change and form of the teeth in the, 525.
Ceratobatis, characters of the new genus, 227.
Ceroma, new species of, 253.
Charaxes, new species of, 112.
Charopa, new species of, 520.
Chelisoches, new species of, 315.
Chiridota contorta, on care of the brood in, 327.
Chloritis, new species of, 411.
Chrysocraspeda, new species of, 106.
Chrysotypus, new species of, 210.
Cicada, new species of, 369.
Cistogaster, remarks on the genus, 284.
Citharinus, new species of, 424.
Cockerell, T. D. A., on bees from New Mexico, 135; on new insects from New Mexico, 510.
Coleoptera, new, 179, 356, 553.
Collinge, W. E., on the anatomy of Apera Burnupi, 221.
Coproxenus, characters of the new genus, 190.
Corixa, new species of, 54.
Cosmopsaltria, new species of, 18.
Cosmosoma, new species of, 303.
Crustacea, new, 446; notes on some rare, 489.
Ctenus, new species of, 342.
Cynthia, new species of, 111.
Dalaca, new species of, 211.
Dasychira, new species of, 202.
Dasyprocta, new species of, 219.
Dasypterus ega, new subspecies of, 544.
Delias, revision of the genus, 143; new species of, 147.
Dendrolimus, new species of, 207.
Desmeocræra, new species of, 204.
Diagramma, new species of, 294.
Diaprepocoris, characters of the new genus, 52.
Diastopora, new species of, 61.
Diodontodesmus, characters of the new genus, 443.
Diplommatina, new species of, 418.
Diptera, new, 19, 272.
Distant, W. L., on Heterocera from the Transvaal, 15, 197; on Cicadidæ from Burma, 17; from the Malay Archipelago, 369.
Distichodus, new species of, 425.
Ditropopsis, characters of the new genus, 416.
Draper, D., on the occurrence of Sigillaria and Glossopteris in South Africa, 116.
Druce, H., on new Tropical American Lepidoptera, 299.
Duerden, J. E., on the Actiniarian family Aliciidæ, 1.
Dycladia, new species of, 303.
Echimys, new species of, 550.
Ellobius, new species of, 308.
Ephuta californica, new variety of, 513.
Ephyra, new species of, 107.
Equus Burchelli, new subspecies of, 44.
Eriococcus, new species of, 514.
Euchloris, new species of, 236.
Eucyane, new species of, 304.
Eunomia, new species of, 303.
Eupithecia, new species of, 66.
Euproctis, new species of, 202.
Eurydirorhachis, characters of the new genus, 435.
Euthisanotia, new species of, 300.
Eutrachyrhachis, characters of the new genus, 441.
Evarne, new species of, 168, 173.
Fawcett, Major J. M., on new Rhopalocera from Burma, 111.
Fishes, new, 227, 294, 305, 420, 422; from Rotuma, on, 371.
Forficularia, new species of, 310.
Froggatt, W. W., on the habits of white ants, 483.
Frondipora, new species of, 64.
Fulton, H., on two new species of Amphidromus, 211; on new species of Oleacina, Trochomorpha, and Bulimulus, 212.
Gattyana cirrosa, on the phosphorescence of, 167.
Gazella Grantii, new subspecies of, 479.
Geological Society, proceedings of the, 116, 248.
Georychus, new species of, 323.
Glugea, new species of, 556.
Gnophria, new species of, 199.
Gobius, new species of, 421.
Gonometa, new species of, 209.

Graphiurus, new species of, 320.
Grose-Smith, H., on new butterflies from the Pacific Islands, 515.
Günther, Dr. A., on some reptiles and a frog from Argentina, 365.
Gymnelia, new species of, 302.
Hæmaterion, new species of, 304.
Halictus, new species of, 142.
Helogale, new species of, 378.
Hemithea, new species of, 232.
Heriades, new species of, 135.
Heros, new species of, 298.
Hister, new species of, 187, 359.
Holland, Dr. W. J., on two new species of Xanthospilopteryx, 291.
Holochila, new species of, 517.
Holothurians, on a new case of care of the brood in, 327, 487.
Homœocera, new species of, 302.
Hoplurorhachis, characters of the new genus, 437.
Hyalomyia, new species of, 30.
Hydrelia, new species of, 77.
Hymenoptera, new, 135, 511.
Hypocista, new species of, 515.
Ichthyomys, new species of, 220.
Ilodesmus, new species of, 439.
Insectivora, on the change and form of the teeth in a family of, 525.
Johnson, J. Y., on new Cyclostomatous Bryozoa from Madeira, 60.
Kirkaldy, G. W., on aquatic Rhynchota, 52.
Labia, new species of, 311.
Lacipa, new species of, 200.
Lælia, new species of, 200.
Læmocharis, new species of, 303.
Lagochilus, new species of, 415.
Lecaniodiaspis, new species of, 514.
Leech, J. H., on Lepidoptera Heterocera from China, Japan, and Corea, 65, 228.
Léger, L., on a new Myxosporidian of the family Glugeidæ, 556.
Leiosoma, new species of, 300.
Lembeja, new species of, 371.
Lepidodactylus, new species of, 306.
Lepidoptera, new, 15, 66, 111, 147, 197, 225, 228, 291, 299, 366, 453, 515.
Lepidosternum affine, note on, 365.
Leptognathus, new species of, 523.
Lepus, new species of, 551.
Lewis, G., on new species of Histeridæ, 179, 356.
Lichenopora, new species of, 62.
Limenitis, new species of, 515.
Lipoptena depressa, new variety of, 289.
Ludwig, Prof. H., on a new case of care of the brood in Holothurians, 327; on care of the brood in Psolus antarcticus, 487.
Lymantria, new species of, 201.
M'Intosh, Prof., on the phosphorescence of Gattyana (Nychia) cirrosa, 167; on a new Evarne, 168; on the British species of Pholoe, 169; on a collection of annelids from Norway, 172.
Macna, new species of, 17.
Madreporidæ, on the interrelationships of the, 130.
Mæra, new species of, 447.
Major, Dr. C. I. Forsyth, on the change and form of the teeth in the Centetidæ, 525.
Mammals, new, 44, 113, 214, 218, 308, 316, 320, 376, 377, 479, 524, 544.
Megalochlora, new species of, 235.
Microgale, on the change and form of the teeth in species of, 525.
Miller, G. S., jr., on the nomenclature of some European bats, 379.
Millipedes, new genera and species of, 427.
Mollusca, new, 211, 212, 409, 519.
Monandroptera inuncans, on phenomena of autotomy in, 473, 476; on the tetrameric regeneration of the tarsus in, 507.
Montipora, notes on the genus, 118.
Mormyrus, new species of, 426.
Mus, new species of, 113, 317, 321.
Myotis, note on the genus, 382.
Myxosporidian, on a new, 556.
Nacaduba, new species of, 518.
Nausigaster, new species of, 25.
Nectomys, new species of, 546.
Nemoria, new species of, 241.
Nicéville, L. de, on a new Papilio from Bali, 225.
Notonecta, new species of, 56.
Nychia cirrosa, on the phosphorescence of, 167.
Oleacina, new species of, 212.
Omphalotropis, new species of, 522.
Orthia, new species of, 299.
Orthoptera, new, 310.
Oryzomys, new species of, 548.

Oryzoryctes, on the change and form of the teeth in species of, 525.
Oxymycterus, new species of, 218.
Pachycrærus, new species of, 181, 358.
Palaina, new species of, 418.
Papilio, new species of, 226.
Papuina, new species of, 412.
Paradesmorhachis, characters of the new genus, 445.
Parasyntomis, new species of, 16.
Paratropus, new species of, 192.
Partula, new species of, 520.
Pelmatochromis, new species of, 422.
Pennapoda, characters of the new subgenus, 282.
Peramys, new species of, 219.
Perdita, new species of, 511.
Pericopis, new species of, 305.
Perrieria, new species of, 414.
Phasis, new species of, 300.
Phasmidæ, on phenomena of autotomy in, 473, 476; on the tetrameric regeneration of the tarsus in, 507.
Phelister, new species of, 361.
Phiala, new species of, 205.
Pholoë, on the British species of, 169.
Phractodesmus, new species of, 438.
Phylloma, new species of, 179.
Phyllomedusa, new species of, 365.
Phyodesmus, new species of, 428.
Pipistrellus, remarks on the genus, 383.
Platyrrhachidæ, new genera and species of, 427.
Platysoma, new species of, 357.
Pocock, R. I., on the species and subspecies of Zebras, 33; on the genera and species of Tropical African Solifugæ, 249; on new genera and species of millipedes of the family Platyrrhachidæ, 427.
Pœcilopsaltria, new species of, 18.
Polydesmorhachis, characters of the new genus, 445.
Pomponia, new species of, 19.
Poritia, new species of, 112.
Potamogale, on the change and form of the teeth in, 525.
Pseudochromis, new species of, 421.
Psolus antarcticus, on care of the brood in, 487.
Psychoda, new species of, 19.
Pterygistes, note on the genus, 383.
Pupinella, new species of, 419.
Pygocœlis, characters of the new genus, 194, 364.
Radiopora, new species of, 63.
Ragadia, new species of, 111.
Reptiles, new, 306, 523.
Rhagodinæ, definition of the new subfamily, 252.
Rhaphiderus scabrosus, on phenomena of autotomy in, 473, 476.
Rhinolophus, new species of, 524.
Rhodostrophia, new species of, 108.
Rhynchota, new, 17, 52, 369, 514.
Rhytida, new species of, 409, 519.
Rothschild, Hon. W., on a new Antelope, 376.
Saccopteryx, new species of, 546.
Salagena, new species of, 210.
Salarias, new species of, 422.
Sauris, new species of, 76.
Saurita, new species of, 301.
Scarabæus, new species of, 553.
Scott, T. & A., on Sunaristes paguri and other rare Crustacea, 489.
Seward, A. C., on the association of Sigillaria and Glossopteris in South Africa, 116.
Sherborn, C. D., on the dates of 'The Zoology of the Beagle,' 483.
Simulium ornatum, on a new Myxosporidian parasitic on, 556.
Smith, E. A., on land-shells from New Guinea, 409; on land and freshwater shells from Rotuma, 519.
Snakes, on some little-known, from Natal, 374.
Solenodon, on the change and form of the teeth in, 525.
Solifugæ, on the genera and species of Tropical African, 249.
Solpuga, new species of, 258; on the habits of, 267.
Solpuginæ, synopsis of genera of the new subfamily, 252.
Spiders, on the Cteniform, of Ceylon, Burmah, &c., 329.
Spilosoma, new species of, 198.
Spongophora, new species of, 313.
Stenoglene, new species of, 206.
Stenoniodes, characters of the new genus, 430.
Sternopygus, new species of, 305.
Sthenelais, new species of, 174.
Stictostix, new species of, 360.
Succinea, new species of, 521.
Sunaristes paguri, note on, 489.
Synodontis, new species of, 423.

Syntomis, new species of, 15.
Tabanus mexicanus, new variety of, 21.
Taphodesmus, new species of, 440.
Taragama, new species of, 208.
Teracolus, revision of the species of, 385, 451, 495.
Termes, on the habits of a new species of, 483.
Tetrastemma græcense, on the excretory organs and blood-vascular system of, 324.
Thalassius, new species of, 351.
Thalassodes, new species of, 241.
Thalera, new species of, 244.
'The Zoology of the Beagle,' dates of, 483.
Thomas, O., on a new rat from China, 113; on new mammals from South America, 214, 218; on two new rodents from Van, 308; on the dwarf mungoose of Somaliland, 377; on a new gazelle from East Africa, 479; on new bats and rodents from America, 544.
Thomson, G. M., on two new Gammarids from New Zealand, 446.
Thysonotis, new species of, 516.
Townsend, C. H. T., on Diptera from Vera Cruz, 19, 272.
Trichopoda, synoptical table and new species of, 272.
Trichopterigia, new species of, 73.
Trichopteryx, new species of, 75.
Trochomorpha, new species of, 212.
Trochonanina, new species of, 410.
Trypeticus, new species of, 362.
Trypobius, new species of, 195; note on the genus, 364.
Venusia, new species of, 83.
Vespertilio, notes on the genus, 379.
Volucella, new species of, 27.
Waterhouse, C. O., on a new Scarabæus from E. Africa, 553.
White ants, on the habits of, 483.
Winton, W. E. de, on small mammals from Uganda, 316; on rodents from Angola, 320; on two new mammals from West Africa, 524.
Woods, H., on the Mollusca of the Chalk rock, 248.
Xanthomelanodes, notes on species of, 285.
Xanthospilopteryx, new species of, 291.
Zebras, on the species and subspecies of, 33.
Zeriassa, characters of the new genus, 255.

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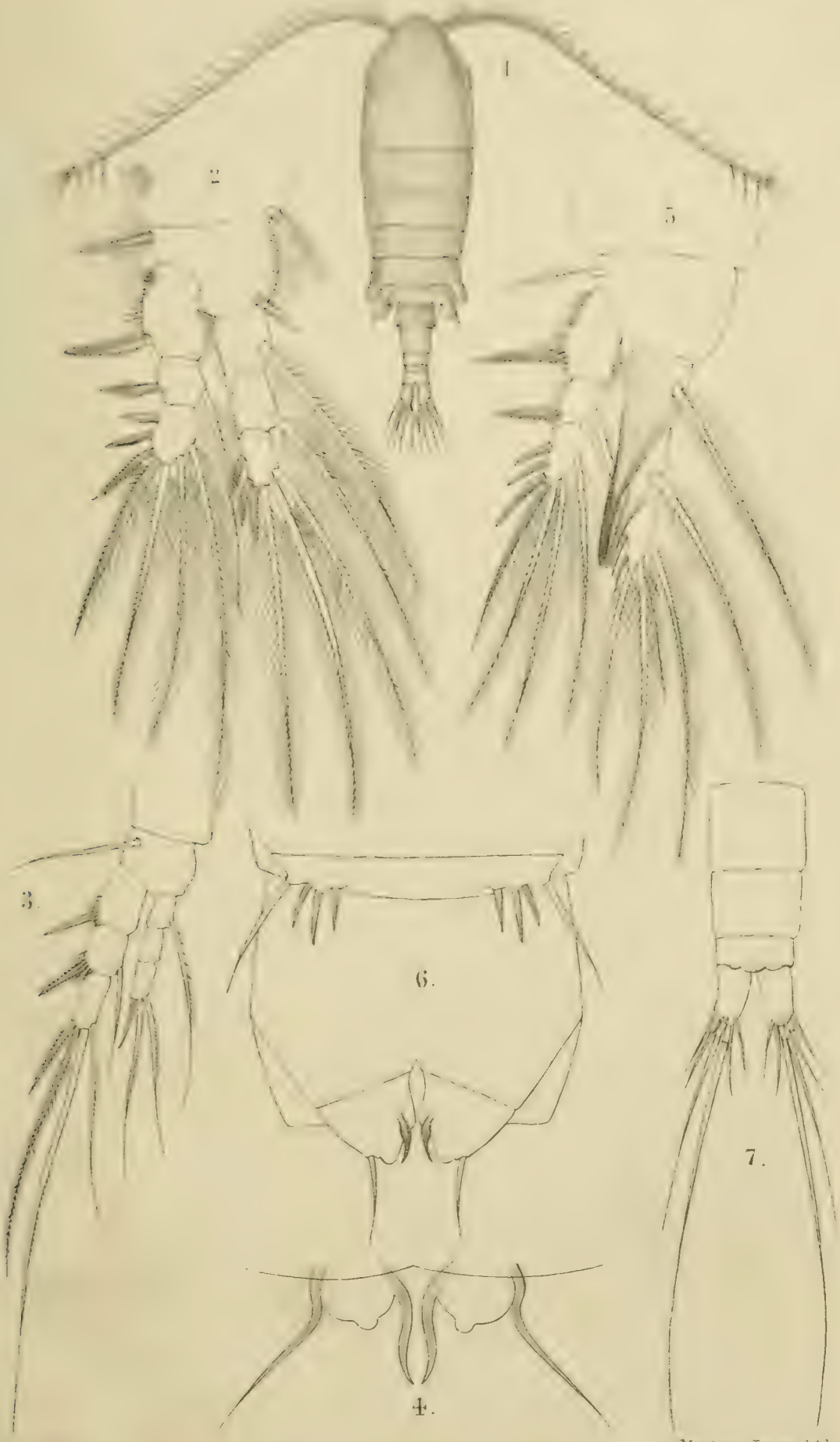

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Fig. 1. DIAPTOMUS LACINIATUS, Lilljeborg.
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